NATIONAL MUSEUM OF VICTORIA

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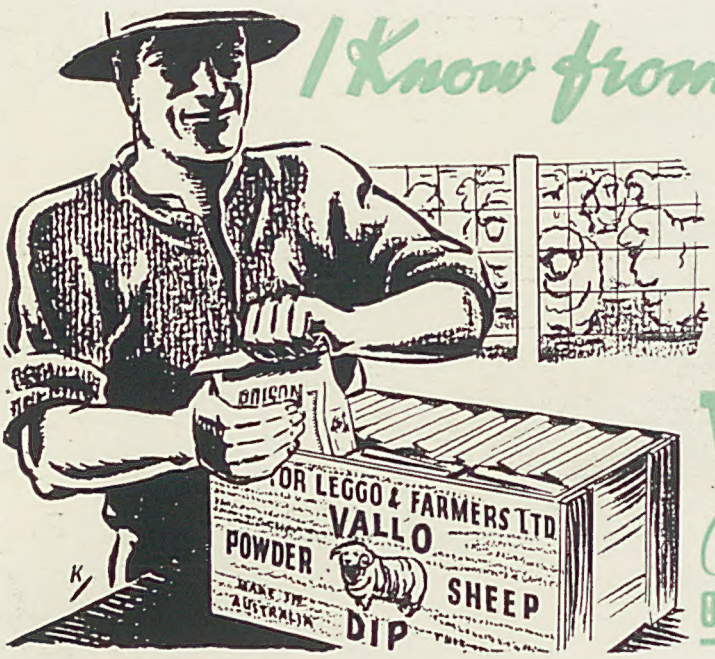

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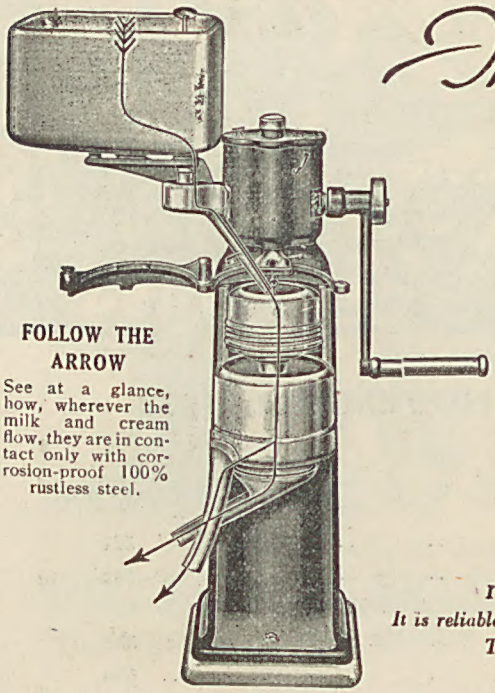

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OIL-BATH, BALL & ROLLER BEARING

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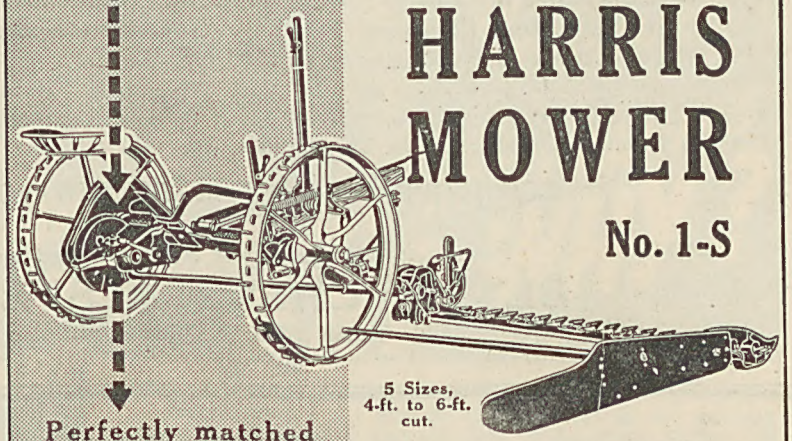

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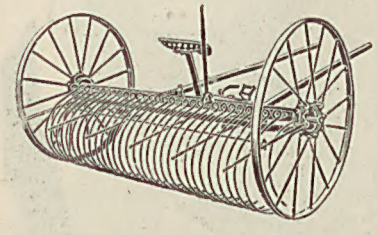

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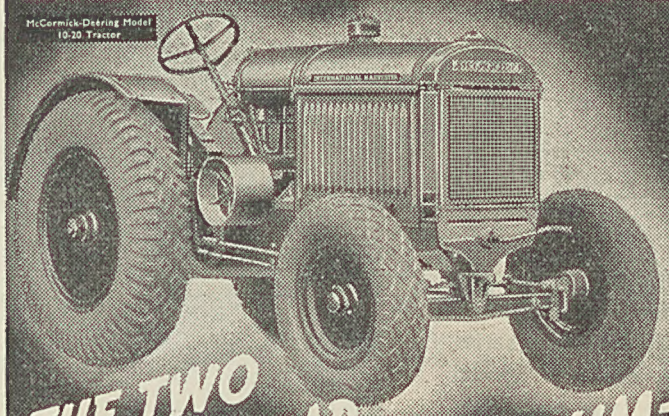

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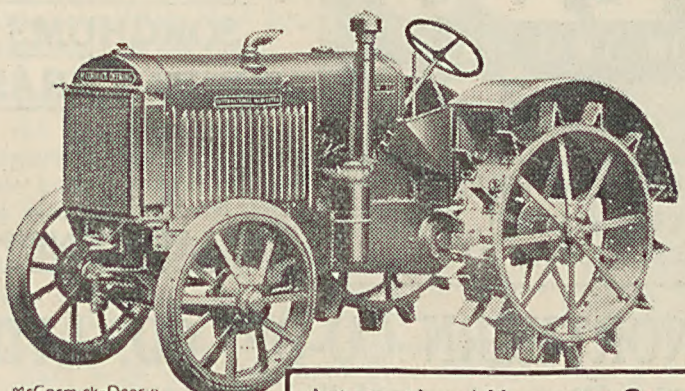

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NATIONAL MUSEUM OF VICTORIA

Some members of Messrs. T. M. Noble and Son's grade Jersey herd which averaged 404 lb. butter-fat in the Maffra Herd Testing Association.

Grade Herd Test

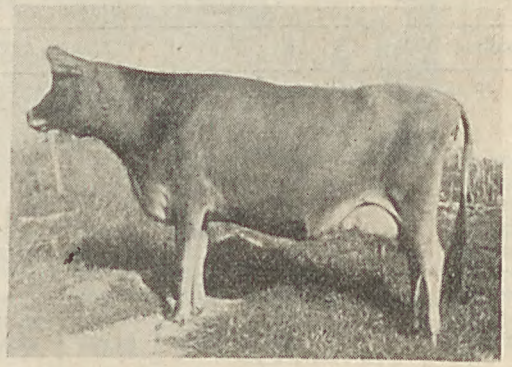
Annual Report, 1937-38

By W. J. Yuill, Supervisor of Herd Testing

WITH the exception of the irrigation areas, the coastal fringe and some isolated areas of the Gippsland hill country, last season was an unsatisfactory one from the dairying point of view. The position perhaps is best illustrated by the fact that during 1937-38, 6,102 tons less butter was produced than during 1936-37, and in last year's report it was stated that unusual weather conditions had been experienced in certain areas of the State.

All areas report some reduction in yield, the north-eastern, east Gippsland, and parts of the western areas being affected most. Considering the unfavorable climatic conditions, and the additional 6,000 cows under test this season, it is surprising to find that the average yield of the 86,770 tested cows shows a decrease of only 17 lb. of butter-fat.

An interesting feature, shown in the summary table on page 522, is that the herd size continues to increase; the average size of the 2,427 herds under test last season was 36. Compared with the years prior to 1932, seven more cows are now milked in the average herd. This difference is most marked in the northern and north-eastern portions of the State. Herds of more than 50 cows were tested by 430 members. Of this number 61 had herds of more than 80 cows while more than 100 cows were tested on 30 farms., The largest herd under test was one of 230 cows.



Mr. J. B. Watson's "Queenie 2nd", leading three-year-old, with 611 lb. butter-fat.

1. Mr. H. Sharples' "Nellie Bly", champion grade cow for 1937–38 with 639 lb. butter-fat.

2. "Nelma" and "Nancy Lee", two high producing daughters of "Nellie Bly".

3. Mr. Sharples' farm at Noojee showing the steep nature of the country where "Nellie Bly" put up such excellent records during the past four years.

Leading Associations.

For the past seven years the Rochester Association has averaged over 300 lb. butter-fat per cow. This remarkable performance has not been equalled by any unit in Australasia. Despite the increased number of cows in the unit, last year's average yield of 312 lb. butter-fat was only 8 lb. below its high record of 1932.

SUMMARY OF HERD TEST ASSOCIATION DATA FOR THE YEAR ENDING 30TH JUNE, 1938.

Area.	Units.	Herds.	Cows.	Junior Cows under Test.		Pure Bred Bulls.		Average Number Cows in Herds.	Average Production per Cow.		
				Heifers.	Per cent.	Bulls.	Per cent.		Milk.	Test.	Butter-fat.
									lb.		lb.
Gippsland ..	44	1,064	37,436	16,628	44·0	857	80·0	35·0	4,844	4·8	231·0
Western ..	32	732	27,373	11,195	41·0	579	80·0	37·0	4,886	4·5	220·0
North-Eastern ..	15	285	10,709	4,346	40·0	249	87·0	38·0	4,220	4·9	206·0
Goulburn Valley ..	13	320	10,530	5,298	50·0	284	88·0	33·0	5,626	4·48	252·0
Totals ..	104	2,401	86,048	37,467	43·5	1,969	83·0	36·0	4,876	4·7	227·0
DATA OF PREVIOUS YEARS.											
1936–37 ..	107	2,350	80,528	36,106	45·0	1,874	81·0	34·3	5,076	4·80	244·0
1935–36 ..	108	2,416	80,817	37,817	47·0	1,946	81·0	33·0	4,934	4·7	233·0
1934–35 ..	113	2,446	79,701	36,116	45·3	1,991	81·4	32·6	5,309	4·59	244·0
1933–34 ..	134	2,910	92,953	43,394	46·0	2,214	76·0	31·7	4,723	4·51	212·0
1932–33 ..	141	3,383	104,009	46,392	44·6	2,619	77·0	31·0	5,290	4·55	241·1
1931–32 ..	130	3,098	89,619	36,946	41·3	2,323	75·6	29·0	5,393	4·58	247·3
1930–31 ..	132	3,085	90,360	32,867	36·4	2,251	73·0	29·0	5,383	4·30	234·0
1929–30 ..	116	2,604	76,032	24,439	32·1	1,653	71·0	29·0	4,944	4·59	226·1
1928–29 ..	96	2,229	63,277	19,246	30·4	1,354	64·0	30·0	5,080	4·38	223·3

Note.—Fish Creek Association data not available.

An equally fine performance was made by the Jindivick-Neerim No. 2 unit, where an increase of 21 lb. butter-fat per cow has been made during the past three years. Their 300 lb. butter-fat average of last year was preceded by one of 292 lb., when they occupied second place among the Gippsland units.

Toora-Welshpool and Dumbalk North have maintained a high average yield for many years; the latter association having wrested from Maffra No. 1 the honour of being the highest producing large unit of the State. An interesting point about the Dumbalk North unit is that, on practically the same farms, the number of cows being milked has increased by at least 50 per cent. The average yield per cow, however, has increased by 100 lb. butter-fat. This is an outstanding illustration of increased yield per farm, and it cannot fail to have a very favorable influence on farm costs.

HIGH-PRODUCING HERDS OF LESS THAN 20 COWS.

(In Order of Merit.)

Owner.	Association.	Number of Cows.	Butter-fat.	Position.
			lb.	
Semple, W. ..	Rochester ..	11	445	1
Paynter, S. E.	Rochester ..	15	442	2
Wallace, H. H.	Swanpool ..	13	415	3
Bentley, A. C. ..	Jindivick-Neerim No. 1	16	408	4
White, C. R. ..	Winchelsea No. 1	11	408	5
Noble, T. M. ..	Maffra, No. 1 ..	18	404	6
Daffy, K. ..	Nalangil No. 1 ..	14	398	7
Meaklim Bros.	Undera ..	14	388	8
McDougall, R.	Jindivick-Neerim No. 2	13	387	9
Bright, Geo. ..	Dumbalk ..	17	384	10
Wilson, J. J. ..	Toora-Welshpool	16	378	11
Palmer, A. E. ..	Jindivick-Neerim No. 2	14	374	12
Freestone, P. A.	North Murchison	17	371	13
Findlay, G. M.	Leitchville ..	15	371	14
Geals Bros. ..	North Murchison	13	369	15
Stanlake, G. ..	Loch	19	362	16
Lukins, M. R. ..	Tallangatta ..	15	359	17
Walker, F. ..	Yinnar ..	10	358	18
Dickson, N. J.	Undera ..	13	356	19
Johnston, W. E.	Bairnsdale ..	10	356	20
Murray, H. C. ..	Kerang ..	19	354	21
Waterhouse, H.	Pakenham ..	19	352	22
Povall, G. ..	Yarra Valley ..	10	352	23

In the western area, the 273 lb. butter-fat average of Winchelsea No. 1 unit was well clear of that of Gellibrand Valley and Apollo

HIGH-PRODUCING HERDS OF 20 TO 39 COWS.

(In Order of Merit.)

Owner.	Association.	Number of Cows.	Butter-fat.	Position.
			lb.	
Sharples, H. ..	Jindivick-Neerim No. 2	23	448	1
Pierce, J. D. ..	Rochester ..	25	422	2
Jackson, H. ..	Rochester ..	28	408	3
Farrari, C. ..	Gellibrand ..	37	396	4
McRae, D. ..	Wonthaggi ..	34	393	5
Evison and Batema	Warragul No. 1	32	382	6
Butler, F. ..	Swan Hill ..	23	382	7
Anderson, R. G.	Rochester ..	36	381	8
Jones, O. ..	Dumbalk North	25	379	9
Findlay Bros. ..	Toora-Welshpool	35	379	10
Wade, W. J. ..	Maffra No. 1 ..	29	377	11
Ussher, O. ..	Stanhope ..	30	375	12
Gunn, K. ..	Leongatha No. 2	33	372	13
Saunders, A. J.	Leongatha No. 3	30	372	14
Moyes, W. J. ..	Jindivick-Neerim No. 1	22	370	15
Morton, A.	Kerang ..	22	368	16
Gasson, E. W.	Toora-Welshpool	30	365	17
Bunn, M. O. ..	Korumburra No. 1	26	363	18
Truscott, T. W.	Toora-Welshpool	25	363	19
Gardner Bros. ..	Toora-Welshpool	20	363	20
Watson, J. B. ..	North Shepparton	35	361	21
Pratt, W. ..	Mountain View ..	39	360	22
Hickey, P. ..	Cobden No. 2 ..	23	360	23
Farrari, F. ..	Gellibrand ..	21	357	24
Edney, W. ..	Jindivick-Neerim No. 2	36	355	25
Cannon, W. ..	Gellibrand ..	21	353	26
Gane, J. ..	Loch	24	350	27

Mr. R. L. Glover's "Hazel", 535 lb. butter-fat.

Bay, each of which exceeded 260 lb. buter-fat per cow. Cobden and Warrnambool averaged 253 and 250 lb. respectively. Each of these associations is testing over 1,000 cows.

The severity of the drought in north-eastern Victoria during last year is illustrated by the 206 lb. butter-fat average per cow in that

area—over 40 lb. lower than that of the peak year of 1932. Eskdale No. 1 unit headed the area averages with 245 lb. buter-fat per cow.

In the irrigation areas the high average yield of the previous year was well maintained. Swan Hill, Kerang, and Stanhope each had yields of 270 lb. per cow or better, while Werribee South was close up with over 1,000 cows on the 268-lb. butter-fat mark.

HIGH-PRODUCING HERDS OF 40 TO 59 COWS.

(In Order of Merit.)

Owner.	Association.	Number of Cows.	Butter-fat.	Position.
			lb.	
Keele and Son	Rochester ..	49	424	1
Swayn, E. A. ..	Stanhope ..	42	395	2
Rawlinson Bros.	Werribee South	40	384	3
Colls, W. E. ..	Jindivick-Neerim No. 2	41	380	4
Bullingham, J. S.	Tongala ..	42	379	5
Howell, J. G. ..	Leongatha No. 1	48	369	6
Stockel, K. ..	Maffra No. 4 ..	56	363	7
Hickey, P. N. ..	North Shepparton	45	360	8
Clarke, W. T. ..	Jindivick-Neerim No. 1	46	356	9
Furphy, H. ..	Dumbalk North..	51	354	10
Shaw, J. A. ..	Swan Hill ..	44	353	11
Charlton Bros.	Stony Creek ..	53	346	12
Waite, J. ..	Traralgon No. 1	59	323	13

Leading Herds.

The highest producing herd of the year was owned by Mr. H. Sharples of Jindivick-Neerim. His 23 grade Jerseys averaged 448 lb. butter-fat. Mr. Sharples' farm is situated in the steep hills at Noojee. The success of this farm and herd reflects alike the industry and ability of the owner. There are many springs on the property, from which water is led out around the hill sides. In this way, an unusual system of irrigating the pastures has been developed. On the "soaks" and "springheads," *Poa aquatica* grows profusely. In the early stages of growth it is ignored by the stock, but it appears to be relished by them during the summer and autumn, for it is then eaten down to ground level. Mr. J. D. Pierce's well known herd at Nanneella, Rochester, followed closely with a yield of 422 lb. butter-fat from 25 cows.

Among the outstanding herds of the year were those of Messrs. H. E. Keele and Son, of Rochester (49 cows and 424 lb. butter-fat), and E. A. Swayn, of Stanhope, whose 42 cows averaged 395 lb. butter-fat. The herds of Messrs. Rawlinson Brothers, of Werribee

HIGH-PRODUCING HERDS OF OVER 80 COWS.

(In Order of Merit.)

Owner.	Association.	Number of Cows.	Butter-fat.	Position.
			lb.	
Batten, H. J., and Sons	Warrnambool ..	101	301	1
McKinnon, N. ..	Warrnambool ..	91	299	2
Williams, F. W.	Narracan No. 2	82	292	3
Bingham, E. J.	Warragul No. 2	80	288	4
Macknamara Bros.	Werribee South	126	286	5
Wheeldon, W. J.	Warragul No. 2	117	285	6
Moore, J., and Co. No. 2	Yarram ..	90	279	7
Gardiner Bros.	Leongatha No. 2	84	267	8
Edey, L. T. ..	Leongatha No. 3	80	267	9
Vagg, A. ..	South Purrumbete	179	265	10
Shaw, O. ..	Camperdown ..	91	259	11
Bailey, W. ..	Werribee South	81	259	12
Wright, E. ..	Woodford ..	84	252	13
Ford, J. A. ..	Kiewa Valley No. 2	81	252	14
Mitchell, R. T.	Paschendale No. 1	94	251	15
Andrews, H. ..	Eskdale No. 2 ..	102	250	16
Zeglin, K. ..	Rochester ..	93	249	17
Cunningham, E.	Werribee South	97	242	18
Keeble, J. ..	Warragul No. 3	90	237	19
Lester, H. ..	Leongatha No. 2	148	235	20

HIGH-PRODUCING HERDS OF 60 TO 79 COWS.

(In Order of Merit.)

Owner.	Association.	Number of Cows.	Butter-fat.	Position.
			lb.	
Kelliher Bros. ..	Jindivick-Neerim No. 1	65	335	1
Trease, J. ..	Dumbalk North	65	328	2
Ford, E. R. ..	Port Campbell No. 1	60	328	3
Walker Bros. ..	Yinnar ..	68	320	4
Crosthwaite, A.	Kiewa Valley No. 2	62	314	5
Hamilton Bros.	Dumbalk North	65	314	6
Cardwell, W. ..	Eskdale No. 1 ..	61	301	7
Fuller, J. B. ..	Dumbalk North	68	295	8
Hallyburton, A.	Pomborneit ..	64	293	9
Clyne, A. G. and B. (No. 3)	Maffra No. 4 ..	69	291	10
Gannon Bros. ..	Winchelsea No. 1	64	283	11
Whittaker, C. G.	Maffra No. 1 ..	63	282	12
Dineen, M. ..	Bunyip ..	63	275	13
Robbins, T. ..	Dumbalk North	60	273	14
Gaul, W. ..	Gainsborough ..	69	272	15
Cleave, T. ..	Leitchville ..	73	270	16
Proctor, J. E. ..	Werribee South	70	268	17
Harrison Bros.	Dumbalk North	68	266	18
Harrison, J. ..	Warragul, No. 2	63	261	19
Noble, H. G. ..	Maffra No. 3 ..	72	260	20

1. A fine group of yearling heifers owned by Mr. W. J. Moyes, Neerim South. 2. Messrs. H. J. Batten and Son's "Ada", 514 lb. butter-fat. 3. Mr. H. Sharples' "Pansy", 512 lb. butter-fat. 4. "Buttercup" (Mr. D. J. McKean), 553 lb. butter-fat. 5. Mr. S. E. Paynter's "Brownie", 585 lb. butter-fat. 6. Mrs. F. Clayton's "Torney", 572 lb. butter-fat. 7. "Trixie", 570 lb. butter-fat, also owned by Mrs. Clayton. 8. Messrs. H. E. Keele and Son's "Jeanette". 9. Messrs. R. Ritchie and Son's "Lubra", 502 lb. butter-fat.

LIST OF TWELVE LEADING THREE-YEAR-OLDS.

Name.	Association.	Name of Cow.	Milk.	Test.	Butter-fat.
			lb.	%	lb.
J. B. Watson	North Shepparton ..	Queenie 2nd ..	9,925	6·16	611
D. McRae	Wonthaggi	Ginger	9,625	5·99	577
Mrs. F. Clayton	Tongala	Trixie	11,153	5·11	570
J. Little	Maffra	Empress	9,640	5·80	563
Macknamara Bros. ..	Werribee South ..	Viola	10,787	5·20	560
D. Ussher	Stanhope	Lobster	9,792	5·51	540
W. Semple	Rochester	Lady	8,499	6·1	525
H. Sharples	Jindivick-Neerim ..	Pansy	7,564	6·76	512
Charlton Bros.	Stony Creek	L. Filbert ..	8,892	5·63	505
K. Gunn	Leongatha	R. Monica ..	8,256	6·08	501
O. N. Alp	Korumburra	Silver	9,070	5·26	476
S. Gale	Ecklin	Roan	8,609	5·45	470

Note.—The first three also appear in the list of twenty best producers for the year.

South (40 cows, 384 lb.) and W. E. Colls, Jindivick-Neerim (41 cows, 380 lb. butter-fat) also had high yields. Mr. J. Bullingham's grade Friesian herd, at Tongala, again produced the highest average milk weight. His 42 cows averaged 10,373 lb. milk and 379 lb. butter-fat. Messrs. J. G. Howell, Leongatha, K. Stokel, Maffra; and P. E. Hickey, North Murchison; also exceeded 360 lb. butter-fat with herds of more than 40 cows.

Associations Grouped According to Area and Production.

Gippsland Area.

Association.	Number of Herds.	Number of Cows.	Percentage of Junior Cows.	Number of Pure Bred Bulls.	Average Yield Butter-fat.
					lb.
Jindivick - Neerim No. 2	26	634	40	14	300
Toora-Welshpool ..	27	875	37	17	293
Dumbalk North ..	25	1,193	31	25	275
Jindivick - Neerim No. 1	22	696	46	21	267
Maffra No. 1 ..	23	1,009	50	33	264
Dumbalk	20	674	60	18	258
Kongwak	26	994	35	18	257
Leongatha No. 3 ..	27	950	47	18	256
Warragul No. 2 ..	25	956	50	19	255
Loch	25	844	52	16	249
Pakenham ..	26	790	37	30	248
Mirboo North ..	27	729	42	22	248
Narracan No. 2 ..	27	734	40	22	247
Stony Creek ..	25	770	48	15	247
Mountain View ..	26	793	52	18	247
Gainsborough ..	18	660	30	10	246
Leongatha No. 2 ..	23	1,038	53	23	245
Bunyip	27	1,016	51	26	241
Warragul No. 1 ..	26	906	41	17	240
Yinnar No. 2 ..	31	840	67	28	238
Narracan No. 1 ..	26	630	44	21	238
Sale	17	510	47	16	237
Leongatha No. 1 ..	29	819	50	17	236
Korumburra No. 2 ..	24	918	48	21	236
Wonthaggi ..	26	937	50	25	235
Korumburra No. 1 ..	27	1,026	42	20	233
Foster	27	769	40	26	232
Bairnsdale ..	13	212	30	9	232
Maffra No. 3 ..	22	916	52	20	231
Peninsula	23	503	55	17	230
Poowong No. 1 ..	17	731	43	8	229
Korumburra No. 3 ..	28	956	42	18	229
Poowong No. 2 ..	17	691	44	12	226
Lang Lang ..	26	772	50	26	222
Yinnar No. 3 ..	21	635	32	16	222
Orbost	24	1,005	34	24	222
Yarra Valley ..	26	587	57	5	221
Yarram	23	1,256	43	32	215
Maffra No. 4 ..	21	991	43	20	215
Boolarra	26	782	45	19	214
Traralgon No. 1 ..	25	1,001	52	21	214
Traralgon No. 2 ..	25	1,061	43	26	210
Warragul No. 3 ..	28	874	46	11	205
Maffra No. 2 ..	21	822	45	17	199
44	1,064	37,436	44	857	231

Note.—Fish Creek returns not available.

Western Area.

Association.	Number of Herds.	Number of Cows.	Percentage of Junior Cows.	Number of Pure Bred Bulls.	Average Yield Butter-fat.
					lb.
Winchelsea No. 1 ..	26	851	36	14	273
Gellibrand Valley ..	28	854	35	16	265
Apollo Bay ..	27	847	48	18	262
Cobden	27	1,112	46	19	253
Warrnambool ..	20	1,019	41	30	250
Condah	21	542	33	18	245
Port Campbell No. 1	24	937	46	7	241
Camperdown ..	21	774	37	21	237
Bacchus Marsh ..	20	530	41	21	235
Woodford ..	20	1,102	38	21	234
Winchelsea No. 3 ..	29	557	31	14	232
Nalangil No. 2 ..	22	870	40	15	228
Port Campbell No. 2	29	650	69	23	224
Drecite South ..	26	916	50	23	222
Pomborneit No. 1 ..	24	1,057	39	16	222
Nalangil No. 1 ..	26	1,088	38	24	221
Becac	26	895	43	16	220
South Purrumbete ..	19	944	40	13	219
Ecklin	22	1,021	51	16	216
Ballarat	19	280	41	15	215
Portland	19	690	31	12	215
South Glenelg ..	20	429	65	20	212
Ondit-Irrawarra ..	23	893	43	16	213
The Sisters ..	24	1,240	36	24	211
Noorat	21	1,445	41	25	208
Paschendale No. 1 ..	22	904	38	16	206
Geelong	26	647	35	17	202
Mortlake	17	703	45	7	199
Casterton	24	1,017	40	18	188
Winchelsea No. 2 ..	27	674	45	13	186
Paschendale No. 2 ..	14	1,078	41	35	179
Coleraine	19	807	39	16	165
32	732	27,373	41	579	220

"Moya", 413 lb. butter-fat as a three-year-old. Owned by Mrs. M. G. Griffin.

In the section for herds of 60 to 79 cows, Messrs. Kelliher Brothers, of Jindivick-Neerim led with 65 cows and 355 lb. butter-fat. Messrs. J. Trease and Hamilton Brothers, Dumbalk North, E. R. Ford, Port Campbell, Walker Brothers, Yinnar, A. Crosthwaite, Kiewa Valley, and W. Cardwell, Eskdale, all had herds of more than 60 cows, with average yields which exceeded 300 lb. butter-fat.

Some very fine records were registered in the large herd section, i.e., for herds of more

Leading Cows.—1. Mr. A. W. Johnson's "Nan", 507 lb. butter-fat. 2. Mr. J. G. Howell's "Beverley", 598 lb. butter-fat. 3. "Queenie", owned by Mr. S. Gale, 528 lb. butter-fat. 4. Mr. H. Heath's "Dolly", 488 lb. butter-fat. 5. Mr. H. Jackson's "Music", 592 lb. butter-fat. 6. "Mapleton Daisy Winks" (Mr. M. O. Bunn), 460 lb. butter-fat. 7. Mr. J. B. Watson's "Daphne II.", 541 lb. butter-fat. 8. Mr. M. W. Reid's "Lady Lena II.", second highest producer for the year with 636 lb. butter-fat. 9. Mr. G. C. Black's "Ballara Dulcie 5th". 10. "Midge" (Mr. H. Jackson), 450 lb. butter-fat. 11. "Bess", "Blackie", and "Lady"—three high-producing members of Mr. J. H. B. Morris' herd. 12. Messrs. H. E. Keele and Son's "Jeanette", 603 lb. butter-fat. 13. "Alanvale Mossy", owned by Messrs. Battley and Sons, 562 lb. butter-fat. 14. Three leading cows in Mr. F. E. Johnson's herd—progeny of "Barney", a proven sire. 15. Mr. W. T. Pratt's "Poley", 576 lb. butter-fat.

Journal of Agriculture, Victoria—November, 1938.

ASSOCIATIONS GROUPED ACCORDING TO AREA AND PRODUCTION—*continued.*

North-Eastern Area.

Association.	Number of Herds.	Number of Cows.	Percentage of Junior Cows.	Number of Pure Bred Bulls.	Average Yield Butter-fat.
					lb.
Eskdale No. 1 ..	11	417	35	7	245
Swanpool No. 1 ..	31	699	51	34	232
Swanpool No. 2 ..	4	139	46	4	227
Euroa	21	420	77	22	226
Tallangatta No. 1 ..	18	891	38	18	214
Eskdale No. 2 ..	19	831	40	16	213
Moyhu	20	687	51	14	212
Myrtleford ..	24	676	52	15	204
Kiewa Valley No. 2	24	1,365	40	20	194
Tallangatta No. 2 ..	23	798	40	18	188
Upper Murray ..	18	1,006	25	14	187
Walwa	9	364	38	8	185
Alexandra.. ..	19	584	45	21	181
Kiewa Valley No. 1	24	1,146	40	24	174
Milawa	20	686	36	14	157
15	285	10,709	40	249	206

Goulburn Valley Area.

Association.	Number of Herds.	Number of Cows.	Percentage of Junior Cows.	Number of Pure Bred Bulls.	Average Yield Butter-fat.
					lb.
Rochester ..	27	796	52	16	312
Swan Hill ..	28	688	50	27	278
Kerang	25	727	46	21	273
Stanhope	28	775	54	26	270
Werribee South ..	21	1,077	46	18	268
Tongala	27	963	65	27	259
North Shepparton ..	22	634	50	19	252
Undera	26	776	48	20	250
Leitchville ..	26	1,024	55	31	249
North Murchison ..	27	854	41	23	239
Cohuna	25	1,126	56	25	230
Calivil	17	540	46	10	226
Pyramid Hill ..	21	550	40	21	216
13	320	10,530	50	284	252

than 80 cows. Messrs. H. J. Batten and Sons', Warrnambool, consistent herd of 101 cows, was again to the fore; their yield exceeding the 300-lb. butter-fat level without any form of concentrates being used. Another large herd to do well without the use of concentrates was that of Mr. N. McKinnon, Warrnambool. His 91 cows averaged almost 300 lb. butter-fat. Mr. F. W. Williams, of Narracan, E. J. Bingham, of Warragul, also did well; while Messrs. Macknamara Brothers, of Werribee South, and W. J. Wheeldon, of Warragul, each had herds of more than 100 cows with average yields of more than 280 lb. butter-fat.

Six of the herds of less than twenty cows had herd averages that exceeded 400 lb. butter-fat. Mr. W. Semple's cows had the good figures of 445 lb. This herd has been mainly bred off Messrs. H. E. Keele and Son's herd, which topped the 40 to 59 cow section. An interesting feature of the "under twenty cow" list is that in it nearly every section of the State is represented. The Dairy Shorthorn herds of Mr. S. E. Paynter, Rochester, and Messrs. Meaklim Brothers, Undera, have been bred off Mr. W. K. Atkinson's Willow Park herd, which for so long has been prominent in the Standard Herd Test. Mr. C. R. White, of Winchelsea, bred his herd mainly off bulls from the St. Albans Stud, a prominent standard test herd of other days.

Mr. H. Wallace, of Swanpool, and Mr. K. Daffy, of Nalangil, each had herds with average yields about the 400-lb. mark. Messrs.

Mrs. A. Dennis' "Mirrinee" which, at 17 years of age, produced 10,530 lb. milk, and 519 lb. butter-fat.

A. C. Bentley, R. McDougal, and A. E. Palmer, are three owners of high-yielding herds that helped to put Jindivick-Neerim Association in such a prominent position in this report. Messrs. G. Bright, of Dumbalk, J. J. Wilson, of Toora-Welshpool, P. Freestone, of North Murchison, and G. Findlay, of Leitchville, again occupy prominent positions. A perusal of the lists will indicate that there are many excellent herds other than those to which reference has been made. It should never be overlooked that any comparison of herds and yields may be unfair unless the size of the herd and the location of the farm receive some consideration.

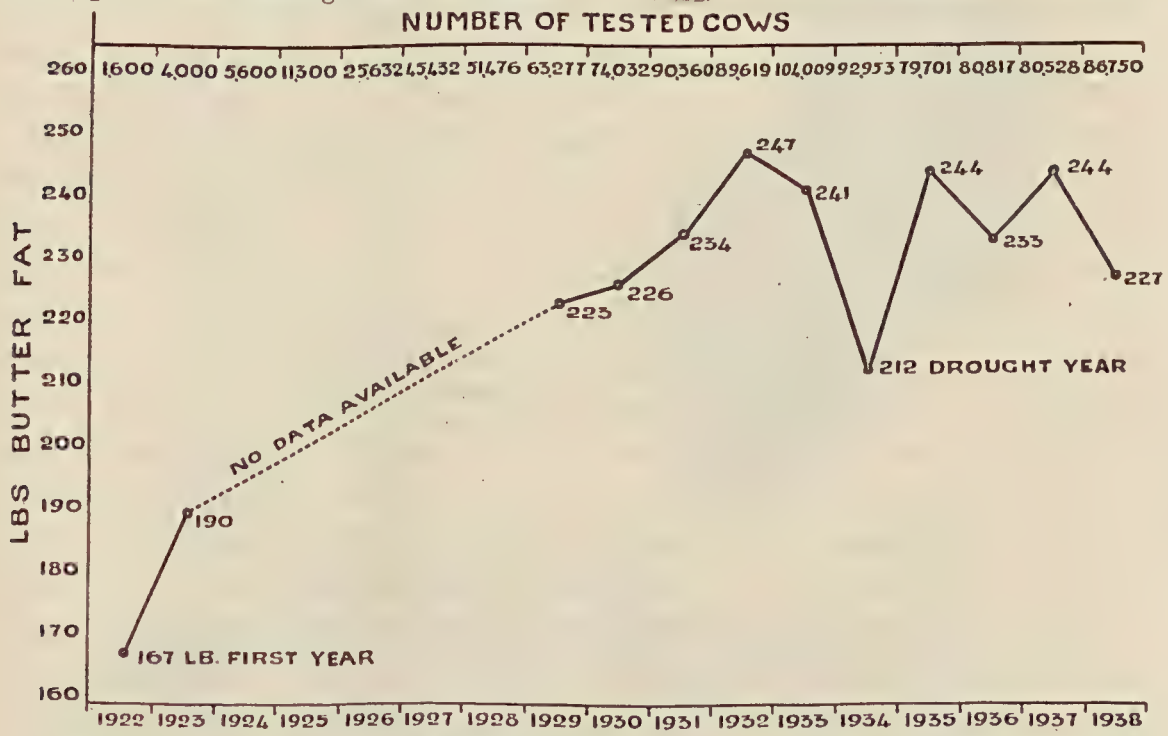
Individual Cows.

Reference has been made in previous reports to Mr. H. Sharples' remarkable grade Jersey cow "Nellie Bly." She is nine years

"Werribee Lord Burnham" has sired many high grade and pure-bred cows in the herd of Mr. T. M. Noble.

old, and has completed seven test periods. Her average yield of 551 lb. butter-fat (without age allowances), indicates to all testing farmers that she is an unusual cow. In each of the past four years she has exceeded 600 lb. butter-fat, and on this occasion is the champion cow of the association test. That she is a real champion is shown by her appearance among the "best twenty producers" of the 80,000 tested grade cows during four consecutive years, being the only cow ever to accomplish this feat. Two of her daughters are in the herd, the oldest being "Nancy Lee." As a junior two-year-old she produced 314 lb. butter-fat, and followed this with 426 lb. as a three-year-old. Her record of 7,008 lb. milk and 449 lb. butter-fat last year was made as a four-year-old. "Nelma," a younger daughter, has even better figures. Her 459 lb. butter-fat

Messrs. H. E. Keele and Son's "Sweetmaid", 602 lb. butter-fat.



Sixteen years of testing work among dairy herds of Victoria. The influence of culling low-yielding cows and breeding from proven good producers together with better feeding and management is shown in the high average yields of the large number of tested cows as compared with those of untested cows. In 1937 the average yield of all cows (tested and untested) was still less than 170 lb. butter-fat.

three-year-old performance was preceded by 379 lb. as a junior two-year-old.

The second highest yielder is "Lady Lena 2nd," a registered Jersey owned by Mr. M. W. Reid, of Gainsborough. She is one of many high-producing cows developed by this breeder during his many years of test work. Her yield last year was 636 lb. butter-fat. Mr. T. Meaklim's "Jean," a Dairy Shorthorn, proved her real dairy ability by gaining a place in the "best twenty" in two successive years. Last season she occupied third place.

Fourth place is occupied by "Queenie 2nd," a member of the herd of Mr. J. B. Watson, of North Shepparton. She is the leading three-year-old of the year. A half-sister, "Daphne 2nd," heads the two-year-old list, while "Minnie," another half-sister, appears among the "best twenty" of the year. All three were sired by "Island King 2nd of Jerseyholm," whose dam and grand-dam are included on the list of high-producing long distance cows of the Standard Test. An Equal Parent Index of this bull shows him to

TWENTY LEADING COWS WITH DETAILS OF OWNERSHIP, IDENTIFICATION, PRODUCTION.

Owner.	Association.	Name of Cow.	Brand.	Milk.	Test.	Butter-fat.
				lb.	%	lb.
H. Sharples ..	Jindivick-Necrim ..	Nellie Bly ..	J 42 29	10,409	6·14	639
M. W. Reid ..	Gainsborough ..	Lady Lena 2nd ..	REG. JERSEY	11,649	5·45	636
T. Meaklim.. ..	Undera	Jean	UD 9 4	11,637	5·31	619
J. B. Watson ..	North Shepparton	Queenie 2nd* ..	F 11 72	9,925	6·16	611
H. E. Keele and Son	Rochester ..	Jeanette	R 1 45	9,712	6·20	603
H. E. Keele and Son	Rochester ..	Sweetmaid ..	R 1 2	10,748	5·60	602
K. Gunn	Leongatha ..	R. Pearl Shell ..	REG. JERSEY	9,639	6·20	598
H. Jackson ..	Rochester ..	Music	BR 68 1	11,157	5·30	592
J. G. Howell ..	Leongatha ..	Beverley ..	L 14 47	11,818	5·01	592
K. Gunn	Leongatha ..	Silverbelle ..	L 6 0	13,094	4·50	591
J. B. Watson ..	North Shepparton	Minnie	F 11 9	9,656	6·05	589
Findlay Bros. ..	Toora-Welshpool ..	Scrubby	W 30 9	10,173	5·79	589
S. E. Paynter ..	Rochester ..	Brownie	BR 8 44	11,687	5·00	585
S. E. Paynter ..	Rochester ..	Fairy	BR 8 28	14,075	4·10	584
D. MacRae ..	Wonthaggi ..	Ginger*	A 42 59	9,625	5·99	577
D. MacRae ..	Wonthaggi ..	Grace	A 42 51	11,455	5·00	573
W. Kelley	Poowong ..	Valley's Record ..	REG. JERSEY	10,221	5·51	573
Mrs. F. Clayton ..	Tongala	Tormey	T 46 5	12,224	4·67	572
Mrs. F. Clayton ..	Tongala	Trixie*	T 46 21	11,153	5·11	570
J. G. Howell ..	Leongatha ..	Boxer	L 14 72	13,158	4·32	569
D. S. Martin ..	Traralgon ..	Jovial Girl ..	REG. JERSEY	9,932	5·73	569

* Queenie 2nd, Ginger, and Trixie also appear in the list of 3-year-olds.

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LIST OF TWELVE LEADING TWO-YEAR-OLDS.

Name.	Association.	Name of Cow.	Milk.	Test.	Butter-fat.
			lb.	%	lb.
J. B. Watson	North Shepparton	Daphne 2nd	8,715	6·2	541
H. Heath	Leitchville	Dolly	8,582	5·68	488
H. Sharples	Jindivick-Neerim	Heriot	8,089	5·92	480
A. T. Thompson	Undera	Pauline	8,188	5·76	472
Rawlinson Bros.	Werribee South	Dermpil	9,942	4·72	467
K. Gunn	Leongatha	Jeanie	7,293	6·2	452
H. Jackson	Rochester	Midge	8,857	5·00	450
K. Daffy	Nalangil	Emmie	9,120	4·87	444
H. H. Wallace	Swanpool	Dainty	7,836	5·67	444
H. Sharples	Jindivick-Neerim	Lucky	6,792	5·72	440
S. Gale	Ecklin	Olga	8,164	5·34	436
T. M. Noble	Maffra	Betty	7,323	5·80	428
Rawlinson Bros.	Werribee South	Bubbles	7,177	6·03	428

be a remarkably prepotent sire. "Sweetmaid," owned by Messrs. H. E. Keele and Son, has previously appeared in this list. On this occasion she and "Jeanette," her herdmate, occupy prominent places with yields of more than 600 lb. butter-fat.

Mr. J. G. Howell, of Leongatha, also has two representatives in the select band of twenty highest producers for the year. "Beverley" and "Boxer" are but two of many of Mr. Howell's cows that have exceeded the 500-lb. butter-fat mark. Indeed, 22 daughters of a grade Jersey bull in this herd have 127 records which average 471 lb. butter-fat (with age allowances). Mr. D. McRae's fine herd at Powlett River is widely known. This year two cows, viz.:—"Ginger" and "Grace" are to be found among the "best twenty." Both appeared in the junior lists of last year. "Ginger's" record places her second among this year's three-year-olds, while "Grace" was one of last year's "twelve best" three-year-olds.

In addition to Mr. Reid's "Lady Lena 2nd," three other registered Jerseys appear on the list. They are "Rydon Pearl Shell," one of the many fine cows sold at Messrs. Smith Brothers clearing sale after several years of Standard test work; W. Kelley's "Valley's Record," and D. S. Martin's "Jovial Girl."

Mrs. F. Clayton's herd at Tongala has recently come into prominence. "Tormey" and "Trixie" represent her herd with yields of 572 and 570 lb. butter-fat respectively. Messrs. Findlay Brothers, Toora-Welshpool, own a cow whose name suggests that, as a heifer, it was not expected that one day she would be one of the best twenty producers of the State. There may be very little in a name, but there is certainly something worth while in "Scrubby's" record of 10,173 lb. milk and 589 lb. butter-fat.

Mr. S.E. Paynter's "Fairy", 584 lb butter-fat.

"Music," a mature cow owned by Mr. H. Jackson, of Rochester Association, occupies eighth position with 11,115 lb. milk and 592 lb. butter-fat. A son of the champion grade cow of 1931 is being used in this herd. Six of his senior two-year-olds averaged 398 lb. butter-fat, and materially helped the herd average above the 400 lb. butter-fat level.

A perusal of the list of leading junior and mature cows indicates that, generally, these individuals possess a generous milk yield, and a good butter-fat test. This feature is prominent every year among the high producers. Small cows may have a very high test associated with a relatively small milk yield, while the opposite is also true. Herd recording work brings out the fact that there are individuals and families, or strains, in all of the

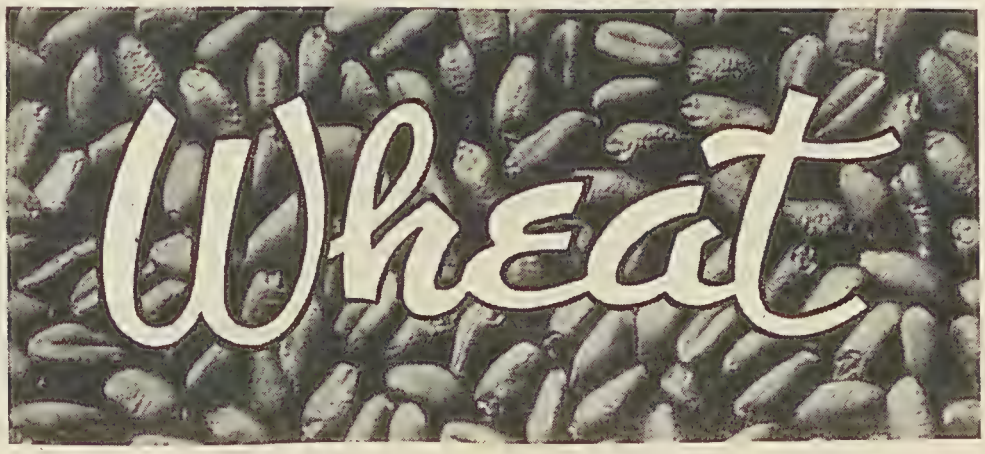
[Continued on page 544

London Markets

Weekly Prices

The following information as to prices offering in London for the principal Victorian primary products has been taken from cablegrams received each week by the Department of Agriculture from the Victorian Agent-General in London.

Product.		Price for Week Ending—			
		7th Oct.	14th Oct.	21st Oct.	28th Oct.
		d.	*d.*	*d.*	*d.*
Lamb, 1st quality, Victorian	29–36 lb.	..	..	..	..
Lamb, 1st quality, Victorian	37–42 lb.	..	..	..	..
Lamb, 1st quality, other States	29–36 lb.	..	..	7⅝	7½
Lamb, 1st quality, other States	37–42 lb.	..	..	7½	7¼
Lamb, 2nd quality, Victorian	28 lb. and under	..	..	..	..
Lamb, 2nd quality, Victorian	29–36 lb.	..	..	..	..
Lamb, 2nd quality, other States	28 lb. and under	..	..	7¼	7⅛
Lamb, 2nd quality, other States	29–36 lb.	..	..	7	6¾
Lamb, 3rd quality, all States	28 lb. and under	6⅝	..	6¾	6⅝
Lamb, 3rd quality, all States	29 lb. and over	..	..	6½	6⅜
Mutton wethers and/or maiden ewes	Under 40 lb.	3⅞	3⅞	3⅞	3⅞
Mutton wethers and/or maiden ewes	41–48 lb.	3⅜	3⅜	3⅜	3¼
Mutton wethers and/or maiden ewes	49–56 lb.	..	..	..	..
Mutton ewes	Under 40 lb.	3⅞	3⅞	3⅞	3¾
Mutton ewes	41–48 lb.	3⅛	3⅛	3	2⅞
Beef, frozen ox hinds	145–210 lb.	4⅛	4¼	4¼	4¼
Beef, frozen ox crops, weights corresponding	..	3½	3½	3⅝	3⅝
Beef, chilled ox hinds	145–210 lb.	5½	5⅝	5¾	5¾
Beef, chilled ox crops, weights corresponding	..	3⅝	3¾	4	4⅛
Pork, Australian 1st quality	60–80 lb.	7¼	7¼	7¼	7¼
Pork, Australian 1st quality	81–100 lb.	7	7	7	7
Pork, New Zealand, 1st quality	60–80 lb.	7¼	7⅜	7⅜	7¼
Pork, New Zealand, 1st quality	81–100 lb.	7	7⅛	7⅛	7
		s.	*s.*	*s.*	*s.*
Bacon, Canadian	per cwt.	93	91	85	85
Bacon, Empire (cured in England)	per cwt.	89	86	83	83
Bacon, Danish	per cwt.	99	99	95	95
Butter, unsalted, choicest grade	per cwt.	116	110–112	110–111	110–112
Butter, unsalted, 1st grade	per cwt.	114	108–109	108–109	109
Butter, unsalted, 2nd grade	per cwt.	..	..	..	..
Butter, unsalted, pastry grade	per cwt.	..	..	..	..
Butter, salted, choicest grade	per cwt.	114	108–110	109–110	109–110
Butter, salted, 1st grade	per cwt.	112	107–109	108	109
Butter, salted, 2nd grade	per cwt.	110	106–107	106	107
Butter, salted, pastry grade	per cwt.	106	104	102–103	103–104
Butter, Danish	per cwt.	128	124	127	134
Market (butter)			Firm at the end of week.	Slow	Firm



A Cheap and Valuable Fodder

By A. C. T. Hewitt, M.Agr.Sc., Dairy Herd Manager, State Research Farm, Werribee

THIS article is intended to familiarize farmers with the relative values of different fodders so that they may buy and feed the cheapest offering. This practice will be to their advantage, and at the same time will tend to stabilize prices. At present, chaff is very dear in comparison with wheat. Roughages are not always cheaper than concentrates, as is generally believed. Straw, the roughest of roughages, is the dearest fodder on the market.

The present range of prices of animal foodstuffs indicates that the relative values of these fodders are not fully understood. Wholesale selling prices for wheat and chaff, quoted in the daily papers on 14th October, 1938, are as follows:—Wheat, 3s. 6d. per bushel, prime oaten chaff, £8 per ton. These prices are very much out of proportion and indicate that buyers do not realize that wheat is as good a food for farm animals as it is for human beings, and a better fodder than most stock foods. Wheat is worth approximately as much per bushel as prime oaten chaff is worth per hundred-weight.

Horses, sheep and cattle can be fed wheat to partly replace such fodders as chaff, bran, pollard, barley, maize and oats. Pigs, poultry, and even dogs, can be fed wheat to replace bran, pollard and other grain. For the displacement of chaff in the ration, 3 lb. of wheat is equivalent to 5 lb. of chaff, and, for horses, sheep and cattle, a proportion of the chaff can be displaced by wheat in that ratio. Except for sheep and poultry, wheat should always be ground before feeding to farm animals. If it is intended to change the rations so that they contain a large proportion of wheat grain, the changes should be gradual, and spread over a period of at least a week. If possible, sudden changes in the rations should be avoided.

Monetary Values of Fodders.

In Table I., relative food values and monetary values, including the prices at which they were quoted in the daily papers on 14th October, 1938, the cost per food unit at these prices, and the actual value of these fodders, based on the actual price of wheat, are shown.

It is seen from this table, that wheat is the cheapest stock-food on the market, costing, at 3s. 6d. per bushel, 0.97d. per pound starch equivalent, in comparison with 2.04d. per pound starch equivalent in oaten chaff, at £8 per ton. These estimated values are based solely on the starch equivalent (the net energy value of the fodder). The protein equivalent has not been taken into consideration, and, on that account, the straws are actually worth considerably less than estimated above, as their protein equivalents are almost negligible. Peas, bran and lucerne chaff have added values on account of their relatively higher protein equivalents.

At present the monetary return for hay is much greater than that for grain, or grain and

straw combined. There are indications that this disparity in values will continue for some time and that farmers will receive greater cash returns by cutting their crops, wherever possible, for hay, instead of harvesting them for grain. The wholesale prices of prime wheaten chaff and wheat grain are £8 per ton, and 3s.6d. per bushel, respectively. At 3s. 6d. per bushel, wheat is bringing only £6 10s. 0d. per ton (2240 lb.), therefore it is worth £1 10s. 0d. more per ton when mixed with chaff. Further, on account of competition brought about by more local and more direct dealing, the margin between the wholesale price and the price received by the farmers (growers) is usually much less for hay and chaff than for grain.

TABLE I.—FOOD VALUES AND MONETARY VALUES OF FODDERS.

Fodder.	Food Values (per 100 lb.).		Monetary Values.		
	Starch Equivalent.	Protein Equivalent.	Price Quoted in Daily Papers, 14th October, 1938.	Cost per food Unit—Starch Equivalent.	Value Based on Present Price of Wheat at 3s. 6d. per Bushel.
	lb.	lb.		d.	
Wheat	72	8·3	3s. 6d. per bushel	0·97	3s. 6d. per bushel
Bran ..	44	9·9	£6 10s. per ton	1·77	£3 10s. 4d. ton
Pollard	69	10·6	£6 10s. per ton	1·13	£5 11s. 7d. per ton
Barley	71	6·8	3s. 2d. per bushel	1·07	2s. 10d. per bushel
Oats ..	62	7·6	3s. 4d. per bushel	1·61	2s. 1d. per bushel
Maize ..	77	7·4	5s. per bushel	1·39	3s. 6d. per bushel
Peas ..	69	18·2	8s. per bushel	2·32	3s. 4d. per bushel
Oaten Chaff	42	3·5	£8 per ton	2·04	£3 16s. per ton
Wheaten Chaff	31	3·0	£8 per ton	2·77	£2 17s. 1d. per ton
Lucerne Chaff	35	8·3	£9 per ton	3·08	£2 18s. 1d. per ton
Oaten Straw	21	0·7	£4 10s. per ton	2·25	£1 18s. 9d. per ton
Wheaten Straw	13	0·1	£4 7s. 6d. per ton	3·17	£1 4s. 3d. per ton
Barley Straw	23	0·6	£4 10s. per ton	2·08	£2 2s. per ton

Wheat for Horses.

When fed to horses, wheat is best coarsely ground and mixed with a proportion of chaff so that the animals will masticate it properly. Also, if ground wheat is not mixed with some coarse foodstuff, it tends to form a paste in the mouth while being eaten, thus reducing the animal's appetite and sticking to the mangers, where it sours and wastes. There is also a tendency to overfeed horses which are given a concentrated ration, as one containing a large proportion of wheat, since they will have consumed sufficient food for their daily needs before their stomachs are full, and, until horses' stomachs are full, they will have appetites and eat more food. If more is given, the animals will probably become foodsick, or show signs of other digestive disorder. Founder may also result from the overfeeding of wheat. This overfeeding must be prevented by allowing only 3 lb. of crushed wheat for every 5 lb. of chaff displaced from the original ration. Further, horses so fed should never have a full day's ration placed before them, as this will also lead to trouble. If the groom wishes to leave sufficient feed out for his horses, so that he can go away for the rest of the day, he is advised to leave out hay or chaff to prevent overfeeding.

The fallacy that wheat grain should never be fed to horses has probably originated from the troubles associated with uncontrolled methods of feeding. At the State Research Farm, Werribee, the horses are fed shandy chaff (wheaten and oaten hay grown in the same field, mixed together), and frequently crushed wheat is used as the grain supplement to replace oats or crushed barley. The ration recommended for a medium draught horse at moderately heavy farm work is 22 lb. chaff and 6 lb. oats daily, but when chaff is dear and wheat is cheap, as at present, this ration could be substituted for one containing 12 lb. chaff, 4 lb. oats, and 8 lb. crushed wheat. This ration should be given in four feeds daily.

Sheep and Dairy Cattle.

For supplementary feeding of sheep, wheat grain can be used in a similar fashion to oats, chaff or hay. The amount of wheat to feed will depend upon the quantity of other feed available and, if it is necessary to feed heavily—above 4 oz. of wheat per head daily—a protein-rich foodstuff, such as linseed or cotton-seed nuts, should be fed in conjunction with the wheat. A new cotton-seed nut, containing blood-meal, has proved to be a highly satisfactory protein supplement to drought-fed sheep.

For dry cattle, ground wheat can be fed to displace most of any other necessary hand-feed, but for milking cows a protein-rich supplement must also be added. At the State Research

Farm, Werribee, concentrate mixtures of ground wheat (five parts) and meat-meal (one part), fed as a supplement to pasture and cereal chaff, have proved satisfactory for maintaining high milk yields as well as improving the butter-fat content of the milk. Large numbers of milking cows are fed insufficient protein and, as a result, quantities of the protein-deficient foodstuffs that are fed are wasted (being undigested) and, therefore, cows prematurely drop in their milk yields and finally dry off. For persistent high production, cows must be fed ample protein. If sufficient protein is fed, as soon as the succulent grass dries off, milking cows will produce well, right into the autumn and winter. Blood-meal, meat-meal, peanut-meal, cotton-seed-meal, linseed-meal, polly feed and brewers' grains (in that order) are the only protein-rich concentrates on the market, in commercial quantities, that will balance rations of dry grass, grain, hay or silage for milking cows. While a mixture of one part of meat-meal and five parts of wheat forms a balanced ration for milking cows, two parts of linseed-meal and three parts of wheat have to be mixed to form a similarly balanced ration. Meat-meal is easily the cheapest protein-rich supplement procurable.

A mixture of 212 bushels of wheat at 3s. 6d. per bushel and 1 ton (2,240 lb.) of meat-meal at £12 per ton will cost £49 2s., the same as 6 tons 2 cwt. 3 qrs. of prime oaten chaff at £8 per ton. The wheat and meat-meal will contain 11,041 lb. starch equivalent and 2,236 lb. protein equivalent in comparison to 5,773 lb. starch equivalent and 481 lb. protein equivalent contained in the 6 tons odd of chaff. In other words, the mixture of 212 bushels of wheat and 1 ton of meat-meal, which is in itself a balanced ration for milking cows, contains nearly twice the food material (starch equivalent) and over four times the protein that is contained in an amount of chaff that at present, costs the same amount of money.

If a mixture of wheat and meat-meal were being fed as a supplement to lucerne chaff or green pasture, the proportions of meat-meal could be reduced to one part per ten parts of wheat, whereas, if fed as a supplement to dry grass, cereal or grass hay or silage, more meat-meal must be added to the wheat, and where this type of roughage forms the bulk of the ration it may be advisable to feed equal parts of ground wheat and meat-meal.

Pigs.

Wheat can be used to displace pollard, barley or maize in rations for pigs. Wheat on its own, or in conjunction with pasture, is not as good as barley, for pigs, but together with skim milk or meat-meal it is quite as good. When fed to pigs, it should be more finely ground than when fed to horses or cattle. Young pigs under eight weeks old can be fed very finely-ground wheat, which is easily digested and, in this respect, wheat is superior to barley.

The proportion of skim milk to feed with wheat can be reduced as the pigs grow older, and the *maximum* quantity of grain that it is advisable to mix with skim milk for pigs of different ages, &c., is shown in Table II. Barley, maize and pollard can be used to displace wheat in this table and meat-meal can be used to displace the skim milk, but from three-quarters to one pound of meat-meal will be necessary to displace one gallon of skim milk.

TABLE II.—SHOWING THE MAXIMUM QUANTITY OF WHEAT TO MIX WITH SKIM MILK TO MAKE A BALANCED RATION FOR PIGS OF DIFFERENT AGES, ETC.

Age in Weeks.	Approximate Live-weights.	Food Allowance per Head Daily.	Approximate Nutritive Ratio.	Maximum Quantity of Wheat to Mix with One Gallon of Skim Milk.
	lb.	lb.		lb.
3 to 8 ..	10 to 25	½ to 1½	1 : 4	1½
8 to 12 ..	25 to 50	1½ to 2½	1 : 5	2
12 to 16 ..	50 to 80	2½ to 4½	1 : 5	3
16 to 20 ..	80 to 115	4½ to 5½	1 : 6	4½
20 to 24 ..	115 to 155	5½ to 7	1 : 7	7½
24 to 30 ..	155 to 220	7 to 9	1 : 8	12½
Sows in pig ..	..	2 to 6	1 : 5	3
Suckling sows ..	..	8 to 14	1 : 5	3
Boars ..	..	3 to 7	1 : 5	3

For further information on the feeding of live stock, those interested may apply to the Director of Agriculture, Melbourne, C.2, for the free pamphlet "Foods and Feeding."

Impaction in Cattle

Precautions to be Observed

By R. N. Wardle, B.V.Sc., Veterinary Officer.

CATTLE belong to the class of animals known as ruminants or cud chewers. To this same class belong other domesticated animals, such as sheep, goats, and camels; and, of course, there are many wild animals which are ruminants—deer, giraffes, llamas, and hippopotami are examples of these. In order to make the subject-matter of this article clear to stock owners, a short account of the anatomy of the digestive organs and of the physiology of digestion of ruminants will be given.

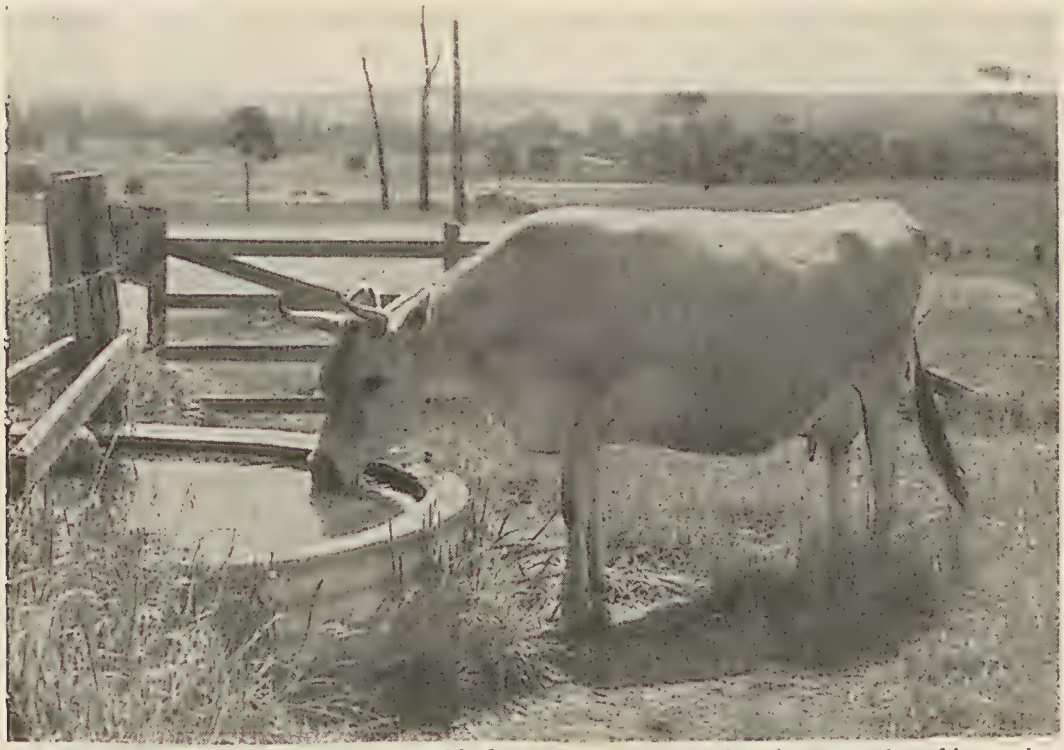
The stomach is a very capacious organ of four divisions, taking up nearly three-fourths of the abdominal cavity. The four divisions are often referred to as the first, second, third, and fourth stomach compartments, and are known in order as the rumen or paunch, the reticulum or honeycomb, the omasum or bible, and the abomasum or rennet. In an adult beast of average size, the capacity of the paunch is 30 gallons, and of the honeycomb 2 gallons. These two organs occupy practically the whole of the left side of the abdomen, while the bible and the rennet, each with a capacity of about 3 gallons, are situated in the right half.

When fodder is eaten by ruminants it undergoes incomplete mastication, during which it is mixed with saliva, and is then swallowed. The bulky material enters the paunch, where it undergoes a churning action, and owing to the admixture of saliva and water, it swells and commences to macerate. By these actions the cellulose in the fibre is brought to a condition for digestion. Fine heavy material passes on to the bible and liquid ingesta to the honeycomb.

Having finished eating, the beast rests—often lying down—and commences to ruminate or chew the cud. In this act a bolus of the coarse, incompletely masticated material from the paunch is regurgitated or brought up the gullet into the mouth, where it is subjected to a more complete remastication, is mixed with a further amount of saliva and then re-swallowed. Further churning takes place in the paunch and reticulum, and eventually the food passes on to the bible and rennet. Much of the fluid is expressed from the ingesta as it passes into the bible, and consequently the food material is of a crumbling consistency. It is in the fourth division or rennet that the food is mixed with the digestive juices, and then passes on through the small and large intestines.

The rate of passage of food through the first three divisions of the stomach is slow. It remains in them for about 60 to 70 hours. From these remarks it will be realized that this process of chewing the cud, which is the characteristic feature of digestion of ruminants, is most important, and one can be certain that should this function be suspended for any reason, a stagnation of food must take place and serious digestive disturbances will inevitably follow.

The two stomach compartments involved in impaction are the paunch and the bible. At the present time in Victoria cases of impaction of the bible are rarely seen, except in the very dry areas, such as in parts of the Mallee country. This is due to the progress in animal husbandry associated with the improvement of pastures and the greater attention which is given to the methods of feeding. Many cases of impaction of the rumen or paunch, however, still occur, particularly in dairy cows. If not actually cases of true impaction, there are certainly many cows affected throughout the year with indigestion varying in degree from acute to chronic, and in the main this indigestion is associated with the paunch. Occasionally one finds cases in which the indigestion is brought about by the swallowing of some foreign body, and many such cases naturally are incurable. Objects included in this category are rope, clothing, portions of hides and skins, rubber, afterbirth, pieces of metal,



An adequate water supply in as many paddocks as possible is an aid in the prevention of impaction.

gravel, and sand, and although hair and fibre balls formed in the paunch may remain for long periods without doing any damage, they do sometimes get into positions in which they may cause symptoms of illness.

Symptoms.

Symptoms vary considerably, but, in all cases, the first sign noticed is that the animal is dull and listless, shows little activity, and is disinclined to move about with other stock to feed. Rumination ceases, and if the patient is a cow in milk, the secretion diminishes, or it may even cease altogether.

In those cases in which there is impaction of the paunch, evidence of the presence of impacted food can be obtained by palpation of that organ on the left side between the last ribs and the point of the hip. As a case progresses there is a general appearance of the flanks being drawn or tucked up, condition is lost rather rapidly, the appetite is completely lost, and the manure which at first may have been normal in consistency, becomes dry and hard, and small in quantity. At this stage the temperature rises three or four degrees from the normal; that is, up to 104 degrees. Movement is often accompanied by grunting, thus giving the false idea of some lung trouble. The patient naturally becomes weaker, and if inflammation is considerable, a rather painful death will ensue.

Post-mortem Appearances.

In cases of impaction of the omasum or bible, the ingesta in this organ will be found to be extremely dry and hard, instead of being of doughy consistency. In fact, the diagnosis can be confirmed by simply feeling the organ, which may be so hard and rocklike that it is impossible to drive a knife into it. The lining membrane of the rennet or fourth stomach division may be inflamed; there is generally a fair amount of ingesta present in the paunch, but the intestine will be found rather empty, except for some masses of dry faecal material in the rectum. In cases caused by foreign bodies there is always considerable inflammation at various points of the digestive tract with which the foreign material has been in contact. It is astounding to discover just what objects have been swallowed at times.

In impaction of the paunch, the post-mortem picture is not so clear: there is always a great amount of doughy ingesta packed into the several sacs of this organ, and the impression is obtained that there has been a stasis of the ingesta due to failure of rumination, and such ingesta has an excessively fermented odour. Impaction of the rumen may be a secondary effect to certain conditions of the liver which, of course, is associated with the digestive tract.

During life the animal may have shown symptoms of impaction, but it is always wise when performing an autopsy to examine all organs. The liver may show in some cases the presence of fluke infestation, abscesses, tumours, or infiltration with fibrous tissue. Some autopsies may show signs of septic pneumonia if material from the mouth has been inspired during drenching operations.

Treatment.

Treatment must commence as early as possible, and be continued beyond the initial drench if relief be not obtained. As a first drench it is recommended that the following be used:—

Epsom salts, 1 to 1½ lb.
Common salt, 2 oz.
Ground ginger, 1 dessertspoonful.
Treacle, ½ lb.
Lard or butter, 1 lb.
Thin oatmeal gruel, 1 quart.

The lard is melted and mixed in the drench. When cool enough to administer it will be found that the lard is still liquid, but it is advisable to keep shaking the mixture during its administration. This drench should be followed in 24 hours with 1 pint liquid paraffin, which may be repeated each day if necessary. If the stage is reached where hard dry faecal material is present in the rectum it may be removed by the hand, after which warm soapy water enemas should be given. Every effort should be made to induce the patient to eat and to chew the cud. Green feed is best, grass hay is good, and often oaten hay will be eaten in small quantities; these long fodders act as stimulants to rumination. All drenching must be done carefully, particularly with a sick animal, as there is often reluctance and partial inability to swallow, and if a drench be given hurriedly or forciby, infected material may be passed down the windpipe to the lungs to cause a septic pneumonia.

Further treatment consists in giving medicine that will stimulate the muscular walls of the digestive organs, and also help to promote cud chewing. The following prescription is recommended:—

Tartar emetic, 1 oz.
Powdered cuichona bark, 1 oz.
Powdered nux vomica, 3 oz.
Powdered carbonate of ammonia, 3 oz.
Powdered gentian root, 4 oz.

Mix and divide into twelve powders. One powder to be mixed with a little treacle just before use, and then pasted on the back of the tongue with a flat stick three times a day.

Causes of Impaction.

Errors in feeding are obviously the cause of indigestion and impaction. Though usually occurring in the dry months when feed is dry and less nutritious, it may also occur at any time of the year under certain conditions. Insufficient drinking water may set up impaction during the summer and autumn. Cattle, and particularly cows in milk, drink a great amount, and where they have to be driven to water once or twice a day it is certain that they will not be able to take a normal amount of fluid to keep the system in order. Impaction of the paunch often occurs where cattle are hand fed, especially when chaff is the fodder used. Chaff generally is cut too fine for cattle. The finely-cut fodder lies in the paunch and the necessary stimulus to induce rumination is not given, and once rumination ceases the food in the paunch will not pass on to the other stomach compartments.

Mineral deficiency plays an important part in cases of impaction. Where such deficiency is present stock will eat all manner of foreign material, such as dry leaves and twigs, manure, contaminated straw litter, especially that from pig sties and fowl pens, pieces of hides and carcasses, bones, sand, rubber, and metal.

Prevention.

Firstly, every endeavour should be made to conserve an adequate water supply on each property, and in as many paddocks as possible. In addition, there should be a trough in or somewhere near the cow yard. Where these conditions cannot be carried out they should be kept in mind, and every endeavour made to see that the milking cows get water several times a day during the dry feed period.

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Silage, for use during the summer and autumn, to some extent, makes up for the lack of green fodder during the dry months.

Secondly, when chaff is being cut for cattle it should be in lengths of about 1 to 1½ inches. This will tend to keep the animals chewing the cud. Lucerne chaff should be available in many dry districts at a reasonable cost, and could be used as an adjunct to the ordinary fodder. Chaff may be steamed or damped down with a mixture of molasses and hot water. In each case fodder so treated should be used within 24 hours. Molasses, besides being a fattening food, is an excellent means of making dry material more appetizing.

Thirdly, provision should be made in non-irrigation districts for the storage of silage to be used in summer and autumn. The lack of green fodder in the dry months is thereby remedied to a great extent. In northern Victoria it is advised that the silage be made from the excess of spring grasses and from self-sown crops.

The following remarks on the making of silage in the dry districts by Mr. H. A. Mullett, B.Agr.Sc., Director of Agriculture, are informative. He states:—"For making silage in the Mallee the pit method is recommended. The pit should be scooped out on a well-drained site. The size will depend on the amount of silage to be conserved. The side walls should be kept perpendicular, and the ends made with a slope of 1 in 3 to enable the drays or wagons to be drawn through the pit when filling takes place. The best stage for cutting the crops is just after the ears have appeared, and no more should be cut at one time than can be placed in the pit. The material must be packed as closely and tightly as possible, as its preservation depends on the exclusion of air. The sheaves should be placed lengthwise in the pit and the bands cut. The passing of the wagons over the material already in the pit will help to compact it. The filling of the pit should be completed with as little delay as possible, and when the pit has been filled to slightly above ground level work on it should cease for two or three days to allow the silage to settle. Filling may then be resumed and the material added until it is about 4 feet above the surface at the centre with a gradual slope towards the ends. It is a good plan when filling above the surface level to overlap the ends of the sheaves about 6 inches over the sides of the pit. If this is done it prevents undue shrinkage away from the walls when settling takes place. Another interval of several days should be allowed to elapse, and the stack again built up to a height of about 4 feet before finally covering with earth to a depth of 9 to 12 inches. It is very important to have the pit well filled, and the covering of the earth should not be put on until it is considered that the material has settled thoroughly."

A good daily ration for a dairy cow consists of 30 lb. of silage to which is added suitable concentrates, and if fed during the period when there is no green feed the incidence of impaction cases will be reduced to a minimum.

Fourthly, it is recommended that, at intervals of four weeks between December and March, the salts drench—without the lard or butter—mentioned previously be given to each milking cow.

Fifthly: Although this recommendation is mentioned last it is by no means the least in importance. Always have before the cattle a quantity of mineral mixture. The formulae recommended are as follows:—

Stock salt, 71 lb.
Di-calcic phosphate, 15 lb.
Sulphur, 5 lb.
Sulphate of magnesium, 3 lb.
Sulphate of iron, 1 lb.
Molasses, 5 lb.

or

Stock salt, 56 lb.
Boneflour, 30 lb.
Sulphur, 5 lb.
Sulphate of magnesium, 3 lb.
Sulphate of iron, 1 lb.
Molasses, 5 lb.

These mixtures may be obtained already mixed, or the ingredients may be purchased separately. In the case of the di-calcic mixture the ingredients, except the salt and molasses, may be purchased as a "di-calcic concentrate." To this concentrate three times the amount of salt by weight is added; also 5 lb. of molasses to each 100 lb. of mixture, and the whole is thoroughly mixed. This forms a convenient and economical method of supplying the minerals in districts where salt is obtainable locally.

The mineral mixture should be placed in troughs or boxes protected from the weather. Where dairy cows are being hand fed three or four oz. of the mixture may be mixed with each feed. The use of these mineral food supplements will supply the animals with those essential mineral constituents, particularly phosphoric acid and calcium. These minerals are necessary, particularly for milking cows and growing stock, and if they are not receiving them in sufficient quantities there will be a loss of tone and resistance to illness will be lowered. In addition, the appetite will become depraved, and the cattle will commence to chew and eat harmful material such as bones, litter, and manure.

Tubercle Free Herds

The following herds have been declared free of tuberculosis under the scheme conducted by the Department of Agriculture. Under this scheme a tuberculosis-free accredited herd of cattle is one in which the entire herd has passed two negative, successive, annual physical examinations and tuberculin tests, or, upon disclosure of infection, three semi-annual, successive physical examinations and tuberculin tests applied by a State Veterinarian or by a qualified and registered veterinarian who is approved by the Chief Veterinary Inspector for that purpose.

ACCREDITED TUBERCLE FREE HERDS.

Herd Number.	Name.	Address.	Number in Herd.	Herd Number.	Name.	Address.	Number in Herd.
1	State Research Farm	Werribee ..	259	10	Banyule Stud Pty. Ltd.	Heidelberg ..	122
2	Warragul High School	Warragul ..	35				
3	Payne, A. E. T. ..	"Yarra View," Lilydale	80	11	McIntosh, John ..	"Burnwood," Merrigum	31
4	Dennis, Mrs. A. A. ..	Frankston ..	14	12	Black, Mrs. Agnes ..	Mount Noorat	40
5	Lady Talbot Milk Supply Company	Cranbourne ..	418	13	Black, I. S. ..	"The Cottage," Mount Noorat	44
6	Reid, Ralph G. ..	"Holmwood," Koo-wee-rup	99	14	Read, John D. ..	"Springhurst Estate," Springhurst	99
7	Harris, J. W. ..	"Rowena," Clyde	72	15	Kelly, C. ..	"Glenmore," Creighton's Creek, Euroa	22
8	School of Horticulture	Burnley ..	8				
9	Lawrence, P. H. ..	"Rainga," Tarrawarra	59	16	Gorman, A. W.	"Cathcart," Alexandra	57

Table Grapes

A Review of the Australian Export Industry

By D. G. Quinn, Viticulturist.

FOR about half a century Australian-grown Ohanez grapes have been exported in cork to Europe; mainly London. Of late years, markets closer to hand have been found more profitable, and during the past four years exports have increased by between ten and twenty thousand cases per year. In 1938, the Commonwealth exported 118,205 cases of Ohanez grapes, while, owing to its late-keeping qualities, appreciable quantities of this variety were also absorbed by the home market.

Superficially the industry is spectacular, in that gross returns exceeding £300 per acre are possible at present prices. On the other hand, the variety has peculiar cropping habits, is very subject to seasonal conditions, and in the case of a good crop, harvesting costs are very high. For a number of years, Victorian packers have complained that they have had to refuse a high percentage of orders owing to insufficient supplies.

While these reports and statistics make it appear that the market in the East is expanding, and while Canada and New Zealand would absorb large quantities but for import tariff rates, a warning note is struck by the Secretary of the Western Australian Export Grape Growers' Association, who has just returned from a visit to some of the Eastern markets, and reports that he is of the opinion that the saturation point has now been reached.

EXPORT OF GRAPES—1937 AND 1938.

Destinations.	N.S.W.	Vic.	W.A.	Other States.	Total 1938.	Total 1937.
United Kingdom	..	..	6,412	..	6,412	3,552
Continent (Stockholm & Hamburg)	..	..	2,011	..	2,011	3,554
Ceylon	25	1,900	26,271	25	28,221	30,697
Straits Settlements	9,260	3,969	26,322	1,270	40,821	29,707
Other Eastern*	6,032	14,392	11,343	1,181	32,948	26,921
Elsewhere	7,051	330	393	18	7,792	6,145
Total 1938	23,368	20,591	72,752	2,494	118,205	..
Total 1937	24,312	13,397	61,745	1,122	..	100,576

*The destination and quantities comprising the item of 32,948 cases exported to other Eastern countries during 1938, with comparative figures for 1937 shown in brackets are:—

India 9,406 (3,208); Hong Kong 5,237 (5,830); Saigon 1,378 (2,805); Bangkok 326 (nil); Netherlands East Indies 9,561 (9,579); Manila 6,560 (3,570); and China 480 (1,929).

The acreage of Ohanez in the Commonwealth is shown in the following table :—

State.	Over 4 years.	Under 4 years.
	acres.	acres.
West Australia	138	75
New South Wales ..	220	..
Victoria (estimated) ..	200	75
Other States	20	..

Non-fruiting characteristics.

Many acres of Ohanez have been planted on the irrigated areas of New South Wales and Victoria, and the vines have fallen off in production after the seventh or eighth year to such a degree that they have been uprooted. The trouble appears to be due not to faulty pollination, but rather to the barren nature of the fruiting canes—the absence of flower bunches—and is more noticeable on soils which induce strong growth than on the heavy shallow soils. This non-fruiting phenomenon is natural to any plant when the top growth is limited by pruning and trellising, and thrown out of balance with a vigorous root system.

To ascertain the opinion of certain practices adopted elsewhere, a questionnaire was forwarded to viticultural experts in adjoining states, and the following extracts are submitted. The New South Wales viticultural expert (Mr. H. L. Manuel), comments :—

"It is general on the Murrumbidgee irrigation area for the yields to diminish after the seventh to eighth year, but, on conversion to the overhead trellis, the vines come back into heavy production. Vines taken from the ordinary to the high trellis show an increase in yield in the first season, the wood fines down, and there is a total absence of rank heavy growth. Over the past three years some areas so treated have averaged over 800 packed export cases per acre. In New South Wales a few growers intend to increase their areas slightly, but all experienced growers are endeavouring to convert their existing areas to the overhead system of trellising, and are erecting the high trellises on a portion of their blocks each year, as funds permit. As regards fertilization, some growers in this area are of the opinion that interplanting is necessary; others do not agree, and last year the Department carried out hand pollination tests, and no benefit could be observed arising from the treatment. Of the total area about 25 acres average under one ton per acre, and about 30 acres average over five tons per acre per year."

Mr. H. K. Johns, Western Australian Government Viticulturist, reports that approximately 20 per cent of the Western Australian Ohanez area is trained on overhead trellis—7 ft. 6 in. high. Although costly, this trellis is giving satisfaction, particularly where irrigation and heavy manuring are practised. The system has many favorable features. It allows plenty of air and light to penetrate to the grapes, which hang underneath the foliage. They are protected from sudden climatic changes, and are not subject to sun scald, wind damage, faulty colour or texture. Perhaps the chief factor favoring the high trellis is that the pruning canes are not crowded as on the ordinary three-wire trellis, and prove far more fruitful. Interplanting is not practised, but hand pollination is given attention. The Ohanez is grown in the deep loamy soils along the Swan Valley under a rainfall of 30 to 35 inches. The area producing under 1 ton per acre is 21 acres, while that producing above 5 tons per acre is approximately 25 acres. Although the chief export variety is the Ohanez, Western Australia also markets overseas a large percentage of the softer grape varieties.

In South Australia Mr. A. G. Strickland reports that under 20-in. rainfall conditions, a yield of 1 to 3 tons is expected, and a "T" head trellis is favored for the production of superior fruiting rods. No artificial pollination is practised, and Muscat, Hamburg, and Zante Currant growing alongside the Ohanez have been noted not to improve the setting.

Conclusions.

From the foregoing, the following conclusions may be drawn :—

As the areas now planted may radically increase in production, and as the price to the consumer must remain high, the markets do not justify any rapid expansion of the area devoted to this crop.

Areas producing over 200 cases per acre and not making over-strong growth, are now considered profitable on the ordinary trellis, but where stronger growth and light crops of fruit of faulty texture are noticed, the grower might quickly estimate the economics of the proposition by raising a small experimental area to the overhead system; and so observe whether his particular soil conditions justify the expense of a change over. An increase of £10 per acre per annum net would be necessary.

Should overhead trellising come into vogue, interplanting becomes impossible.

Showing the method of construction of an overhead trellis for Ohanez grapes.

Root pruning by sub-soiling is effective where soils do not justify the overhead trellis.

At the request of Ohanez growers, the Victorian Department of Agriculture proposes this year to establish several small areas on overhead trellising for observational, and possibly, demonstrational purposes. The accompanying photograph illustrates the details of the construction of such a trellis. Murray Pine uprights 8 inches in diameter and 9 feet long are used with parallel top plates of 5 inches diameter, wire twitched to uprights. The end posts require strutting and parallel wires are run through the uprights at intervals of 18 inches. Such a trellis costs approximately £100 per acre to erect. For economic reasons some growers use the Hardy "T" piece in lieu of the continuous top plate. Minor tests to ascertain if there are several strains of Ohanez and if hand pollination is effective are being established, and certain other treatments are being placed under close observation.

Handling, packing and pre-cooling.

Considerable attention has been paid of late years to the picking, packing, and storage of fresh grapes. The length of the cold storage life of most fruit is increased by early picking, but the grape, unlike most other fruit, contains no starch, and so does not increase in sweetness once the bunch is severed from the vine. This means that grapes must be allowed to reach an edible stage on the vine, and this curtails their possible life in cold storage. However, rapid deterioration goes on between the picking time and the time they reach the cool stores, and pre-cooling a few hours after picking becomes a very important matter. This season, the Victorian Department of Agriculture, working in conjunction with the Council for Scientific and Industrial Research, is conducting a series of tests on Mildura fruit to measure the importance of this point. Even at this early stage the advantages of pre-cooling prior to a long train journey to the point of shipment is evident, and it was observed that the cork insulation prevented the re-heating of the fruit during transit.

In Western Australia, the procedure recognized generally as the best one is to pick and pack in the vineyard, irrespective of excessive heat. Grapes gathered in the morning are delivered to the refrigerating store at mid-day, while the afternoon pickings are delivered the same evening. The former practice of picking and conveying to the packing sheds in small open trays is gradually being abandoned in all States in favor of field packing.

The cases are packed on the flat; medium sized spongy cork is preferred, though fine cork is superior to very coarse cork. Some shippers are showing an inclination to place above 32 lb.

of fruit in the standard export case and this does not leave room for sufficient cork packing. When consignments turn out well buyers may be pleased, but it is a practice which should be discouraged.

Impregnating the cork with various disinfectants such as bisulphites, iodine, &c., is being tried, but it is doubtful whether sound fruit requires assistance in this manner. The keeping quality of the fruit varies from year to year. In wet autumns a certain amount of breakdown occurs, as very fine splits appear at the junction of the berry and the pedicle. Some growers experience this trouble also if they water near picking time. The disease Oidium also lowers the keeping quality of the fruit. Over a period of years, observations in Victorian cool stores indicate that 32° Fahrenheit is the best storage temperature for grapes.

Sawdust Packing.

For many years Australia, in the off season, has been importing from California grapes packed in sawdust. For a long time a search for a suitable sawdust has being going on in Australia, as most timbers have been noticed to impart a wood taint. Recent tests made by the Queensland Forests and Agricultural Departments have shown that the Queensland hoop pine, reduced to sawdust by a special saw, and then specially treated, leaves the grapes free of taint after a storage period of four and a half months. Owing to the low recovery of sawdust of the required coarseness from the Australian types of saw so far tried, only limited quantities of this sawdust are available, and the price in consequence does not compare favorably with cork filler.

Advantages of Sawdust.

It has been observed that sawdust has certain advantages compared with cork. Cork filler gives rise to a slight musty, corky flavor, due no doubt to the very fine dust it contains. With sawdust no taint is noticed in the sound fruit, although a few damaged berries may have a faint wood taint, caused possibly by the juice damping the wood. Another advantage in favor of sawdust is that it does not adhere to the fruit in the same way as cork when the grapes are unpacked. Apparently it can be cleaned of fine dust better than cork, and this causes the bunches to open up much fresher in appearance, the fruit maintaining its natural "bloom".

The weight of sawdust used per case is practically double that of cork, and in these initial tests, the fruit in sawdust definitely kept in better condition than that stored in cork. The latter fruit had a tendency to show nests of decayed fruit, whereas the sawdust pack was comparatively free from this fault.

Grade Herd Test

(*Continued from page* 531).

breeds, that possess both characteristics in high degree—within the limits peculiar to the breed. Some system of milk recording and testing is essential if these are to be discovered and developed.

It is pleasing to record that 6,242 more cows were under test last season. Old world dairy countries also report similar activity. Germany is placing all dairy cows under test in a compulsory system. Denmark is testing nearly 50 per cent. of her total cow population. Sweden, Holland, Finland, Switzerland, Italy, Danzig, and our sister Dominion, New Zealand, are all tending towards more and more herd recording, since it is being made the basis of selection for breeding programmes and rational herd control. Some opinions of world authorities, which were expressed at the tenth world Dairy Congress at Berlin last year, help to lay emphasis on more and more herd recording work, both among the pure bred herds and the commercial herds of the State.

Codling Moth and Williams Pears

Goulburn Valley Investigations

By L. W. Miller, B.Agr.Sc., Assistant Entomologist.

DURING the 1937-38 fruit season the investigation of the problem of the control of the codling moth in Williams pears was continued. A progress report, dealing with the investigations conducted during the 1936-37 season, was published in the October 1937 issue of this *Journal*. As in the previous season the site of that portion of the investigation involving field work was at Ardmona, where Messrs. Turnbull Bros. kindly placed portion of their orchard at the disposal of the Victorian Department of Agriculture. The portion of the orchard used consisted of 1,024 trees of the Williams variety in one solid block of 32 trees square for spraying trials, and a small section of 80 trees adjoining the block was used for bandaging experiments. The whole block was extremely uniform in appearance consisting of trees of 27 years of age, and in full bearing. The laboratory work was centred at a laboratory at the Ardmona Cannery, Mooroopna.

The following report sets out the results obtained during the second year of the investigation:—

Marked differences were noted in the weather experienced at Mooroopna during the two seasons of the investigation, 1936-37 and 1937-38. The rainfall for 1936 was 21.08 inches, 13.83 inches of which fell during the winter period between April and August inclusive. The annual rainfall for 1937, however, was only 12.40 inches, 5.74 inches of which fell during the winter months.

The average monthly minimum temperatures during the winter months of 1937 were lower than those for the previous year, particularly during the months of June and July, when very low minimum temperatures were recorded. During these same months, however, the average maximum temperatures were higher than those for 1936. The high maximum temperatures, but lower minimum temperatures during the winter of 1937 as compared with those of the previous winter, were due to the number of dry, clear, frosty days experienced during 1937. From August onwards, throughout the fruit season, both the average monthly maximum and minimum temperatures were appreciably higher during 1937 than they were during the same period in the previous year.

Owing to seasonal conditions the Williams pears were in blossom approximately fourteen days earlier than in the previous year. As will be seen later the emergences of the codling moth were also considerably earlier than in the previous year.

The average monthly temperatures were as follows:—

—	Maximum.		Minimum.	
	1936	1937	1936	1937
March	83·6	80·8	56·7	56·3
April	67·1	69·5	47·1	48·4
May	64·3	61·4	40·8	43·8
June	54·1	56·7	38·7	36·8
July	54·1	56·7	41·1	36·9
August ..	58·5	61·4	42·1	42·7
September ..	61·3	65·3	42·9	44·8
October ..	69·0	72·6	46·6	50·9
November ..	75·1	81·9	49·8	55·3
December ..	79·4	82·7	57·4	57·8
	1937	1938	1937	1938
January ..	76·8	89·7	53·6	53·1
February ..	82·8	92·7	57·7	51·9

The adult codling moth.

Life History Studies.

Studies of the life history of the codling moth in the Goulburn Valley were conducted in (*a*) the laboratory, and (*b*) the orchard.

Laboratory Studies.

At the conclusion of the 1936-37 season, large numbers of overwintering codling moth larvae were collected and allowed to cocoon in strips of corrugated cardboard. These, together with a number of overwintering larvae in tubes—the detailed life histories of which were known—were kept in the laboratory at Mooroopna during the winter of 1937, and constituted the material for life history studies in the 1937-38 season.

Daily emergences of moths were recorded, the moths sexed, and then transferred to oviposition jars. These oviposition jars consisted of large glass jars 10 inches high and 8 inches in diameter, lined with cellophane, and containing about 1½ inches of moist sand in the bottom to maintain a reasonable humidity within the jars. A 10 per cent. sugar solution was used as a food supply for the moths. The open ends of the jars were covered with muslin. Oviposition

Table I.—Summary of Data relative to the Life History of the Codling Moth. Mooroopna, Victoria, 1936-1938.

	Days.					
	Maximum.		Minimum.		Average.	
	1936–37.	1937–38.	1936–37.	1937–38.	1936–37.	1937–38.
Spring Brood.						
Prepupal period	..	300	..	188	..	261
Pupal period	..	53	..	9	..	21
Total cocoon period	..	320	..	210	..	280
Egg adult period	..	358	..	236	..	285
Preoviposition period	12	12	2	2	5	4
Oviposition period	20	15	1	1	11	7
First Brood.						
Incubation period of eggs	13	15	5	4	10	10
Feeding period of larvae	51	56	19	17	27	27
Prepupal period	15	31	2	1	7	9
Pupal period	24	28	9	8	15	14
Total cocoon period	..	53	..	12	..	23
Egg adult period	85	92	48	42	58	62
Preoviposition period	13	4	2	1	4	2
Oviposition period	13	8	1	1	5	4
Second Brood.						
Incubation period of eggs	11	9	3	4	6	7
Feeding period	35	32	14	11	22	21
Prepupal period	11	18	2	2	5	7
Pupal period	16	17	9	10	11	14
Total cocoon period	..	32	..	15	..	21
Egg adult period	55	59	38	37	47	48
Preoviposition period	No eggs	9	No eggs	1	No eggs 1936	2
Oviposition period		12		1		7
Third Brood.						
Incubation period of eggs	..	10	..	4	..	7
Feeding period of larvae	..	40	..	11	..	23
Prepupal period	..	18	..	7	..	13
Pupal period	..	10	..	6	..	8
Total cocoon period	..	27	..	21	..	24
Egg adult period	..	53	..	43	..	50
Preoviposition period	Moths did not oviposit.					
Oviposition period						

Showing larvae and pupae of the codling moth.

took place on the cellophane lining of the jar. Each day the moths were transferred by means of a sucker to fresh jars, and the number of eggs deposited on the cellophane lining determined.

As numerous transferences tended to damage the moths a modification of the above technique was adopted, in that the eggs on the cellophane linings were marked with a distinctive colour, using a different colour for each day of oviposition. By using this method it was possible to considerably decrease the transferences of the moths. The eggs were cut out on strips from the cellophane linings, labelled, placed in trays and allowed to develop normally. The incubation period of each egg was determined, note being taken of the black spot stage—this stage representing evidence of the fertility of the egg, and being actually the head capsule of the larva beneath the egg covering. When the egg reached this black spot stage, it was placed in a muslin covered jar containing a pear, allowed to hatch, and the resulting larva allowed to feed through normally on the tissues of the fruit.

When the mature larvae left the fruit, they were placed in small glass vials 3 inches x $\frac{5}{8}$ inch, plugged with cotton wool, and allowed to spin up against the walls of the vial. By examining these tubes daily, it was possible to observe the prepupal and pupal periods. The moths were allowed to emerge normally in the vials, and then transferred to oviposition jars. The life history work was then repeated as previously described. These life history studies were continued throughout the season.

The number of broods of codling moths obtained in the laboratory, and the details of each brood for the two seasons 1936-37 and 1937-38, at Mooroopna, are set out in Table I.

A study of the figures in Table I reveals that in the 1937-38 season there were three distinct broods of moths which produced viable eggs in the laboratory, i.e., the spring brood, first brood, and the second brood. A small number of third brood moths emerged in the laboratory, but did not oviposit. In the 1936-37 season, however, there were only two broods of moths that produced viable eggs.

In Table II. are shown the actual brood dates for the two seasons. It will be noted that the emergence of spring brood moths in the 1937-38 season commenced fifteen days earlier than in the previous year.

In Table III. the figures for the percentage of larvae overwintering in each brood in the two seasons are set out.

Table III.—Percentage Overwintering in Each Brood.

——	1936–37.	1937–38.
	%	%
First brood	7·14	5·56
Second brood	87·72	22·22
Third brood	..	88·31

In Table IV. is set out the length of life of the sexes of the various broods of moths.

In Table V. is set out the percentage of the sexes in the moths of the various broods. It is revealed that, in general, the percentage of

Table II.—Summary of Data of Emergence of Broods

	First Emergence.		Last Emergence.		Peak Emergence.	
	1936–37.	1937–38.	1936–37.	1937–38.	1936–37.	1937–38.
Spring brood	12.10.36	27.9.37	29.11.36	30.11.37	5.11.36	31.10.37
First brood	30.12.36	7.12.37	31.1.37	21.1.38	12.1.37	24.12.27
Second brood	2.3.37	26.1.38	12.3.37	21.2.38	..	16.2.38
Third brood	..	31.3.38	..	1.4.38	..	..

TABLE IV.—LENGTH OF LIFE OF THE SEXES IN THE DIFFERENT BROODS.

	Days.					
	Maximum.		Minimum.		Average.	
	1936–37.	1937–38.	1936–37.	1937–38.	1936–37.	1937–38.
Spring Brood.						
Life of males	32	21	2	2	11	10
Life of females	32	21	3	2	13	11
First Brood.						
Life of males	16	14	1	1	7	7
Life of females	16	14	2	1	7	6
Second Brood.						
Life of males	..	13	..	2	..	8
Life of females	..	14	..	2	..	8

either sex present in any brood usually approximates to 50 per cent. The low percentage of males in the second brood 1937-38 is difficult to account for.

TABLE V.—THE PROPORTIONS OF THE SEXES PRESENT IN THE DIFFERENT BROODS.

	Percentage of Males.		Percentage of Females.	
	1936–37.	1937–38.	1936–37.	1937–38.
Spring brood ..	48·33	49·32	51·67	50·68
First brood ..	48·37	50·10	51·63	49·90
Second brood ..	..	39·51	..	60·49

In Table VI. is set out the number of eggs produced per female in respect to the various broods in the laboratory. The higher figure obtained for the average number of eggs per female for the first brood in 1937-38, as compared to the number for the same brood in 1936-37 may possibly be due to the different type of oviposition jar used.

TABLE VI.—THE NUMBER OF EGGS PRODUCED PER FEMALE FROM THE VARIOUS BROODS.

	Maximum.		Average.	
	1936–37.	1937–38.	1936–37.	1937–38.
Spring brood ..	25	28	5·34	4·96
First brood ..	45·5	42	5·16	9·12
Second brood ..	No eggs	38	..	15·34
Third brood ..	..	No eggs	..	..

An oviposition jar.

FIELD STUDIES.

In the field the life history studies consisted of observing the emergence of moths in emergence cages placed in the open, adjacent to the spraying block. Four emergence cages of the same type as used in the 1936-37 season were used (1), (2). The cages were so arranged on posts 30 inches above ground so that there was one cage facing each of the cardinal points of the compass.

Approximately 100 cocooned larvae were placed in each cage. These were allowed to emerge normally as moths, the number of such emergences being determined twice a week.

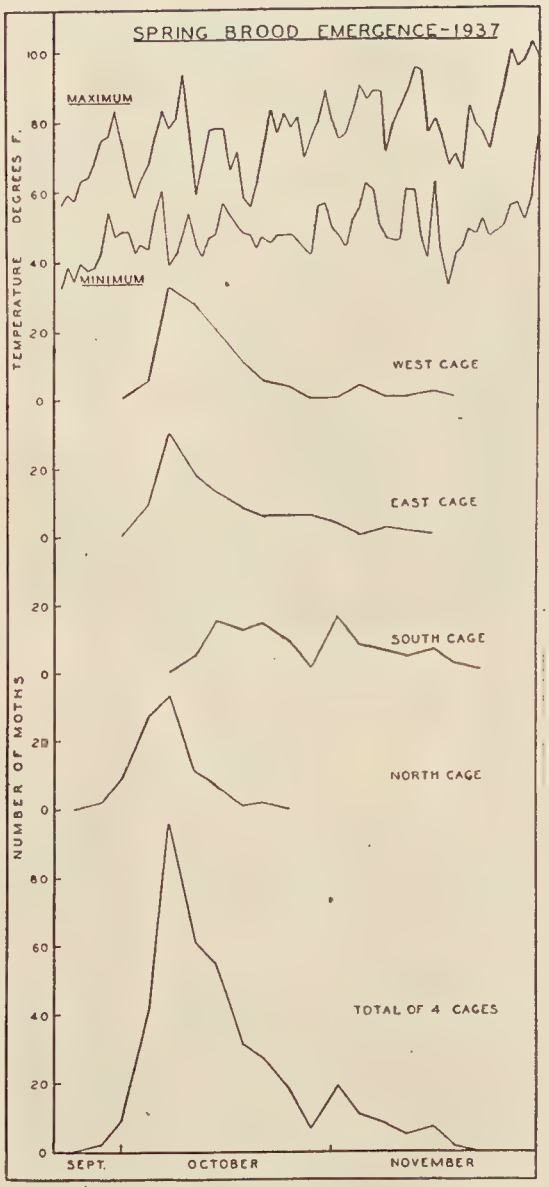
TABLE VII.—EMERGENCE OF MOTHS FROM EMERGENCE CAGES IN THE FIELD. ARDMONA, 1936 and 1937.

	1936.	1937.
North—		
First Emergence ..	22.10.36	27.9.37
Peak	9.11.36	7.10.37
Last	19.11.36	21.10.37
South—		
First Emergence ..	5.11.36	11.10.37
Peak	9–16.11.36	1.11.37
Last	3.12.36	18.11.37
East—		
First Emergence ..	19.10.36	4.10.37
Peak	5.11.36	7.10.37
Last	19.11.36	11.11.37
West—		
First Emergence ..	26.10.36	4.10.37
Peak	9.11.36	7.10.37
Last	19.11.36	15.11.37

Table VII. sets out the date of first, last, and peak emergences for the spring brood in the two seasons 1936-37 and 1937-38. The details of the above emergences and the total emergence for the spring brood in 1937 are shown in Graph I, in which the emergences are plotted against maximum and minimum daily temperatures.

A study of this graph reveals that, in 1937, the first emergences occurred in the cage facing north (on 27th September, 1937), and in this cage the total emergence was completed earlier than in any other cage. Emergences from the east and west cages commenced on the 4th October, 1937, but from the south cage they were later (on 11th October, 1937). This fact of the varying emergences from these cages may be the explanation for the prolonged emergence of any particular brood in the field. The larvae hibernating on the southern side of the tree tend to emerge later than those on the other sides, thus prolonging the emergence of the brood.

A comparison of the emergence dates for the two seasons, Graph II., shows that whereas in the 1936 season the first emergence occurred in the east cage on the 19th October, 1936, in the 1937 season the first emergence was in the north



Graph I.—Showing emergences of spring brood moths from the emergence cages together with the maximum and minimum temperatures at Ardmona for the period September to November, 1937.

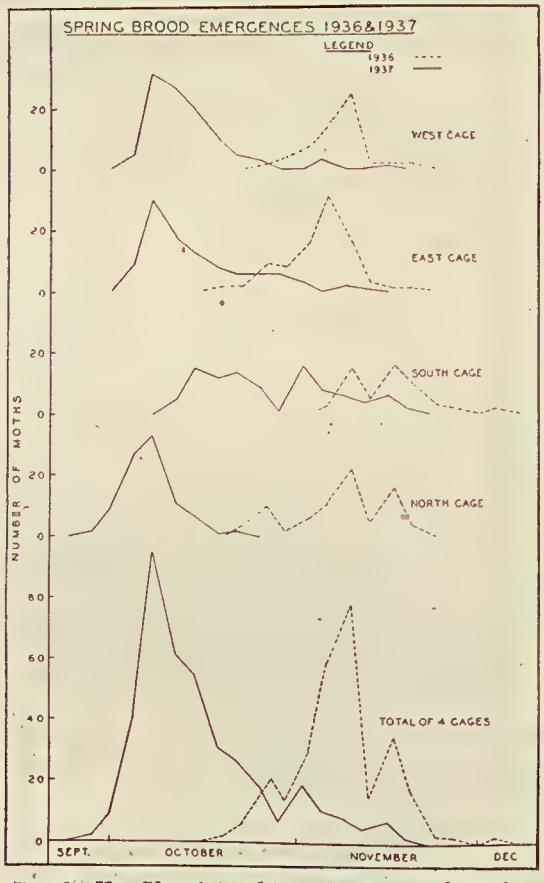
cage on the 27th September, 1937. Thus moth emergence commenced 21 days earlier in the 1937 season than in 1936.

Codling Moth Activity.

Lure records were taken throughout the season in order to have some guide as to the

activity of the codling moth within the orchard. These records were obtained by the use of lure pots which were hung in the trees, and filled with an attractant solution. The lure pots consisted of straight-sided glass jars capable of holding 1 pint of the attractant liquid. Three different attractant liquids were used, namely, a 10 per cent. vinegar solution, a 10 per cent. golden syrup solution, and a 10 per cent. molasses solution. Twenty-seven lure pots were used, there being nine lure pots of each of the three solutions. Records of the numbers of moths caught in the lures were taken twice each week, and plotted on a graph against the daily maximum and minimum temperatures (see Graph III).

From this graph and from the records obtained in the laboratory studies, it is deduced that there were three distinct broods of codling moth during 1937-38. The first moth of the spring brood was trapped in the lures on 27th September, 1937, and the last of this brood on 29th November, 1937, with the main peak of activity on 1st November, 1937. A slightly smaller peak of activity occurred on 18th October, 1937. The first moth of the first brood was trapped on 6th December, 1937, and from then until 7th February, 1938, moths were caught continually. During this period three peaks of activity occurred, namely, on 28th December, 1937, 11th January, 1938, and on 25th January, 1938.



Graph II.—Showing the emergence of spring brood moths—Ardmona, 1936 and 1937.

From Graph III. there appears to have been an overlapping of the first and second broods during the latter part of January, 1937. It is assumed, however, that the first moths of the second brood were trapped at the end of January. This second brood continued until 24th February, 1938, with a small peak of activity on 17th February, 1938. In the field there were no indications of third brood moths.

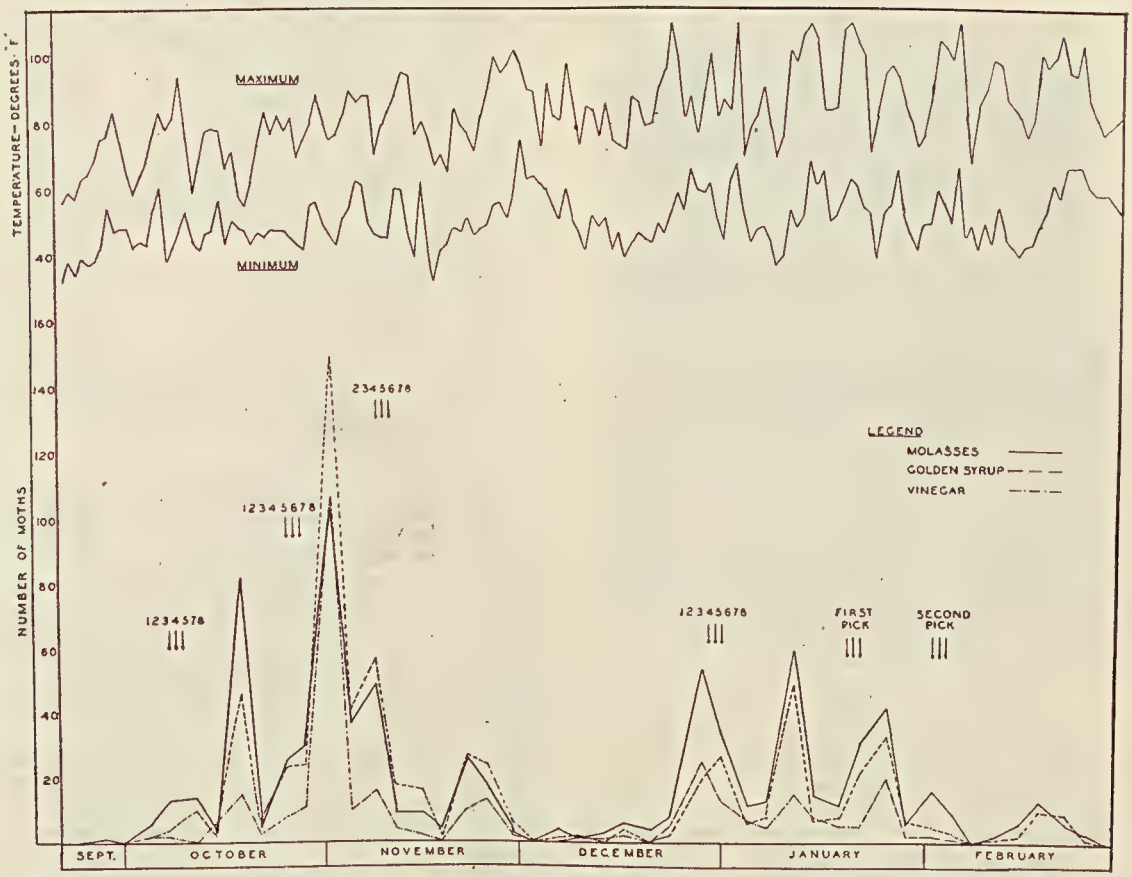
In Table VIII. is given the number of moths of each sex trapped by each of the three lure solutions. The figures reveal that lures containing either 10 per cent. molasses or 10 per cent. golden syrup trapped a far larger number of moths than those containing a 10 per cent. vinegar solution.

TABLE VIII.—NUMBER OF MOTHS TRAPPED IN EACH LURE SOLUTION TESTED. ARDMONA, 1937–38.

Lure Solution.	Number of Moths.		
	Male.	Female.	Total.
10 per cent. Vinegar ..	179	141	320
10 per cent. Golden Syrup ..	308	376	684
10 per cent. Molasses ..	373	424	797

During the previous season, 1936-37, 32 lure pots containing a 10 per cent. vinegar solution were used in positions throughout the experimental block. The same lures were again used in the same trees during 1937-38. During 1936-37 the total number of moths trapped in the above lures was 203. During 1937-38, however, the total number of moths caught in the lures was 630. This can possibly be accounted for by the meteorological conditions being more favorable for lure catches during the latter season.

The catch of moths in the lures was used as the basis for timing the spray applications Spraying dates and the treatment numbers are shown on Graph III.



Graph III.—Showing catches of moths in each of the three lure solutions of 10 per cent. vinegar, golden syrup, and molasses—Ardmona, 1937–38. The maximum and minimum temperatures are shown also.

Control Experiments.

Control experiments were conducted at Ardmona, and consisted of two main parts—

(*a*) spraying and
(*b*) banding tests.

Spraying Experiments:—These were conducted on the same block of Williams pears as in the previous season, 1936–37. The block of trees was in the form of a square, there being 32 trees in each of 32 rows. Eight different spray progammes were used, the field plots being in the form of a Latin square. Each schedule was replicated eight times in this Latin square, the unit of treatment being a block of sixteen trees in a square 4 x 4.

At harvest time, only the fruit from the centre four trees of each unit was used in computing the percentage of codling moth infested fruit present. All of the fruit in each of the two pickings was hand sorted, no distinction being made between calyx entrances, side entrances, or stings. In addition, all windfall fruit was picked up during the season, sorted and included in figures of codling moth infestation in the fruit. Spray applications were made at a pressure of approximately 300 lb. per square inch, rods being used for sprays applied up to and including 27th October, 1937, and pistols for later applications.

The spray programmes were devised to show the effect on codling moth control of—

(*a*) Using spray schedules containing different strengths of arsenate of lead.
(*b*) Incorporating with standard acid arsenate of lead a spreader of summer white oil.
(*c*) A spray schedule consisting of a combination of standard arsenate of lead and summer white spraying oil.

(*d*) Two spray schedules, one being applied according to codling moth activity within the orchard, and the other being what might be termed "the old Goulburn Valley schedule."

(*e*) Using a single calyx aplication of acid arsenate of lead delayed until the peak of spring brood activity.

(*f*) A spray programme consisting of calyx sprays of standard acid arsenate of lead with cover sprays of summer white oil.

The following spray schedules were used, the times of application of each spray being:—

Programme No. 1.—(In each case the spray consisted of arsenate of lead paste 5 lb. to 80 gallons of water.)

(*a*)	Calyx spray	7.10.37
(*b*)	First cover spray ..	25.10.37
(*c*)	Second cover spray ..	29.12.37

Programme No. 2.—(3 lb. lead arsenate paste to 80 gallons of water.)

(*a*)	First calyx spray ..	8.10.37
(*b*)	Second calyx spray ..	26.10.37
(*c*)	First cover spray ..	9.11.37
(*d*)	Second cover spray ..	31.12.37

Programme No. 3.—(Arsenate of lead paste 5 lb. to 80 gallons of water.)

(*a*)	First calyx spray ..	7.10,37
(*b*)	Second calyx spray ..	25.10.37
(*c*)	First cover spray ..	8.11.37
(*d*)	Second cover spray ..	29.12.37

Programme No. 4.—(Lead arsenate paste 8 lb. to 80 gallons of water.)

(*a*)	First calyx spray ..	9.10.37
(*b*)	Second calyx spray ..	27.10.37
(*c*)	First cover spray ..	10.11.37
(*d*)	Second cover spray ..	30.12.37

Programme No. 5.—(The calyx sprays consisted of 5 lb. arsenate of lead paste to 80 gallons of water, while the cover sprays were made up of 1 gallon of summer white oil in 60 gallons of water.)

(*a*)	First calyx spray ..	7.10.37
(*b*)	Second calyx spray ..	26.10.37
(*c*)	First cover spray ..	8.11.37
(*d*)	Second cover spray ..	29.12.37

Programme No. 6.—(5 lb. of lead arsenate paste to 80 gallons of water.)

(*a*)	Calyx spray	25.10.37
(*b*)	First cover spray ..	8.11.37
(*c*)	Second cover spray ..	30.12.37

Programme No. 7.—(In this case the spray consisted of 5 lb. of lead arsenate paste plus 1 pint of summer white oil, to 80 gallons of water.)

(*a*)	First calyx spray ..	8.10.37
(*b*)	Second calyx spray ..	26.10.37
(*c*)	First cover spray ..	9.11.37
(*d*)	Second cover spray ..	31.12.37

Programme No. 8.—(Arsenate of lead paste 5 lb., plus summer white oil, 1 gall., in 80 gallons of water.)

(*a*)	First calyx spray ..	8.10.37
(*b*)	Second calyx spray ..	26.10.37
(*c*)	First cover spray ..	9.11.37
(*d*)	Second cover spray ..	30.12.37

The fruit from the experimental block was harvested in two pickings, the first being from 19th to 21st January inclusive, and the second from 1st to the 3rd February inclusive.

The percentages of codling moth infested fruit are set out in detail in Table IX.

TABLE IX.—PERCENTAGE OF CODLING MOTH INFESTED FRUIT IN EACH UNIT OF TREATMENT OF SPRAY BLOCKS—(The figure in brackets indicates the spray programme used.)

11·27 (1)	14·71 (2)	7·45 (3)	10·83 (4)	7·91 (5)	15·08 (6)	6·98 (7)	4·01 (8)
8·78 (2)	8·01 (3)	7·11 (4)	8·44 (5)	13·29 (6)	6·81 (7)	3·19 (8)	9·31 (1)
4·05 (3)	5·44 (4)	8·53 (5)	18·38 (6)	6·54 (7)	3·36 (8)	7·28 (1)	11·27 (2)
4·08 (4)	5·70 (5)	18·29 (6)	7·90 (7)	3·99 (8)	6·91 (1)	11·58 (2)	12·58 (3)
6·47 (5)	7·75 (6)	4·38 (7)	3·39 (8)	7·92 (1)	14·40 (2)	9·56 (3)	6·46 (4)
9·55 (6)	4·62 (7)	2·95 (8)	8·48 (1)	6·02 (2)	10·00 (3)	3·97 (4)	5·15 (5)
4·94 (7)	4·62 (8)	14·18 (1)	9·60 (2)	7·92 (3)	4·81 (4)	6·15 (5)	15·54 (6)
5·16 (8)	11·27 (1)	15·87 (2)	5·37 (3)	5·62 (4)	4·48 (5)	15·37 (6)	9·28 (7)

On examining the figures in Table IX. statistically the information set out in Table X. is obtained.

TABLE X.—SHOWING STATISTICAL EXAMINATION OF CODLING MOTH PERCENTAGE FIGURES.

Analysis of Variance.

Due to—	Degrees of Freedom.	Sum of Squares.	Mean Square.
Rows	7	58·7659	
Columns ..	7	52·03915	
Treatment ..	7	599·0534	85·57906
Error	42	225·74585	5·374901
Total ..	63	935·6043	

$$\text{Standard error} = \sqrt{\frac{5{\cdot}3749}{8}} = {\cdot}8197$$

Significant difference = 2·295 per cent.
F value of experiment (actual) = 15·92
F 1% value of experiment = 3·1

On averaging the figures quoted in Table IX. the following percentage of codling moth infested fruit is obtained for each of the eight spray programmes.

Programme No. 1	..	9.58 per cent.
Programme No. 2	..	11.53 per cent.
Programme No. 3	..	8.12 per cent.
Programme No. 4	..	6.04 per cent.
Programme No. 5	..	6.60 per cent.
Programme No. 6	..	13.90 per cent.
Programme No. 7	..	6.43 per cent.
Programme No. 8	..	3.83 per cent.

A study of these figures, together with the figure obtained for significant differences in Table X., brings out the following facts:—

(*a*) There was no significant difference in control obtained where a spray programme consisting of two calyx sprays and two cover sprays of arsenate of lead paste, 5 lb. to 80 gallons of water, was compared with one, consisting of two calyx sprays and two cover sprays of arsenate of lead paste 8 lb. in 80 gallons of water. There was, however, a significantly poor control obtained when a spray consisting of two calyx sprays and two cover sprays of arsenate of lead paste 3 lb. in 80 gallons of water was compared with either of the above programmes. (Programmes Nos. 2, 3, and 4.)

(*b*) There was no significant difference in control obtained where a spray programme consisting of two calyx sprays and two cover sprays of arsenate of lead, 5 lb. to 80 gallons of water was compared with one consisting of two calyx and two cover sprays of arsenate of lead paste, 5 lb. to 80 gallons, plus 1 pint of summer white spraying oil to 80 gallons of water. (Programmes Nos. 3 and 7.)

Pupation tubes used in the laboratory tests.

(*c*) There was a significant improvement in the control of codling moth obtained where a programme consisting of two calyx and two cover sprays of arsenate of lead, 5 lb., plus summer white spraying oil 1 gallon, to 80 gallons of water was compared with one consisting of two calyx and two cover sprays of 5 lb. arsenate of lead only to 80 gallons of water. (Programmes Nos. 3 and 8.)

(*d*) There was a significantly poor control of codling moth obtained where a programme consisting of one calyx and two cover sprays of arsenate of lead, 5 lb. to 80 gallons of water, was used, the calyx spray being delayed until the peak of moth activity, as compared with a programme of two calyx and two cover sprays of arsenate of lead 5 lb. to 80 gallons of water. (Programmes Nos. 3 and 6.)

(*e*) There was no significant difference in control where a spray programme consisting of two calyx sprays of arsenate

of lead 5 lb. to 80 gallons of water, and two cover sprays of summer white oil, 1 gallon to 60 gallons of water, was compared with one consisting of two calyx and two cover spays of arsenate of lead, 5 lb. to 80 gallons of water. (Programmes Nos. 3 and 5.)

(*f*) When the so-called "average Goulburn Valley programme" (Programme No. 1) is compared with all other programmes, there is significantly improved control present in four of these, viz., Programme No. 4, consisting of two calyx and two cover sprays of arsenate of lead, 8 lb. to 80 gallons of water. Programme No. 5, consisting of two calyx sprays of arsenate of lead paste, 5 lb. to 80 gallons of water, and two cover sprays of white oil, 1 gallon to 60 gallons of water. Programme No. 7, consisting of two calyx and two cover sprays of arsenate of lead paste, 5 lb., plus 1 pint of summer white spraying oil, to 80 gallons of water, and Programme No. 8, consisting of two calyx sprays and two cover sprays of arsenate of lead paste, 5 lb., plus 1 gallon of summer white spraying oil, to 80 gallons of water. (Programmes Nos. 1 to 8.)

Separate records with respect to picked fruit and windfall fruit were kept throughout the harvesting. Table XI. shows the codling moth infestation of the picked fruit expressed as a percentage of the total fruit grown in each unit of treatment.

Table XI.—Showing Codling Moth Infestation of Picked Fruit Expressed as Percentage of Total Fruit for each Unit.

4·42	6·31	3·26	4·38	3·40	8·53	2·25	·53
2·10	2·05	3·87	2·51	4·30	2·48	·41	4·38
1·39	2·31	1·52	6·40	2·91	·85	2·93	4·53
1·96	1·21	6·63	2·49	1·32	2·35	6·40	6·57
2·52	3·09	2·16	·62	2·97	8·50	5·99	2·47
4·60	3·00	·60	3·85	2·67	6·56	1·67	2·06
1·11	1·41	7·32	4·39	3·83	2·22	1·90	3·58
1·45	4·60	7·32	1·59	1·72	·90	4·37	2·41

On statistically examining the figures in Table XI., the information contained in Table XII. is obtained.

Table XII.—Showing Statistical Analysis of Codling Infestation of Picked Fruit.

Analysis of Variance.

Due to—	Degrees of Freedom.	Sum of Squares.	Mean Square.
Rows	7	11·537075	
Columns ..	7	17·3815	
Treatment ..	7	138·8077	19·8297
Error	42	95·6652	2·2777
Total ..	63	263·3914	

$$\text{Standard error} = \sqrt{\frac{2\cdot2777}{8}} = \cdot5336$$

Significant difference = 1·49 per cent.
F value of experiment (actual) = 7·13
F 1% value of experiment = 3·1

On averaging the figures quoted in Table XI. the following percentage of codling moth infestation in the picked fruit is obtained for each of the spray programmes:

Programme No. 1	..	4.10 per cent.
Programme No. 2	..	5.28 per cent.
Programme No. 3	..	3.91 per cent.
Programme No. 4	..	2.58 per cent.
Programme No. 5	..	2.00 per cent.
Programme No. 6	...	5.19 per cent.
Programme No. 7	..	2.35 per cent.
Programme No. 8	..	.90 per cent.

A study of the above figures in conjunction with the figure of 1.49 for significant differences as shown in Table XII. reveals the following facts:—

(*a*) There was no significant difference in codling moth infestation of the picked fruit where a spray programme consisting of two calyx and two cover sprays of arsenate of lead paste 5 lb. to 80 gallons of water was compared with one consisting of two calyx and two cover sprays of arsenate of lead paste 3 lb. to 80 gallons of water. (Programmes Nos. 2 and 3.)

(*b*) There was no significant difference in the codling moth infestation of picked fruit where a spray programme consisting of two calyx and two cover sprays of arsenate of lead past 5 lb. to 80

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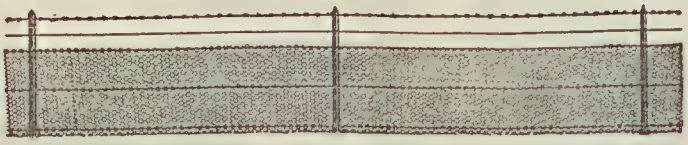

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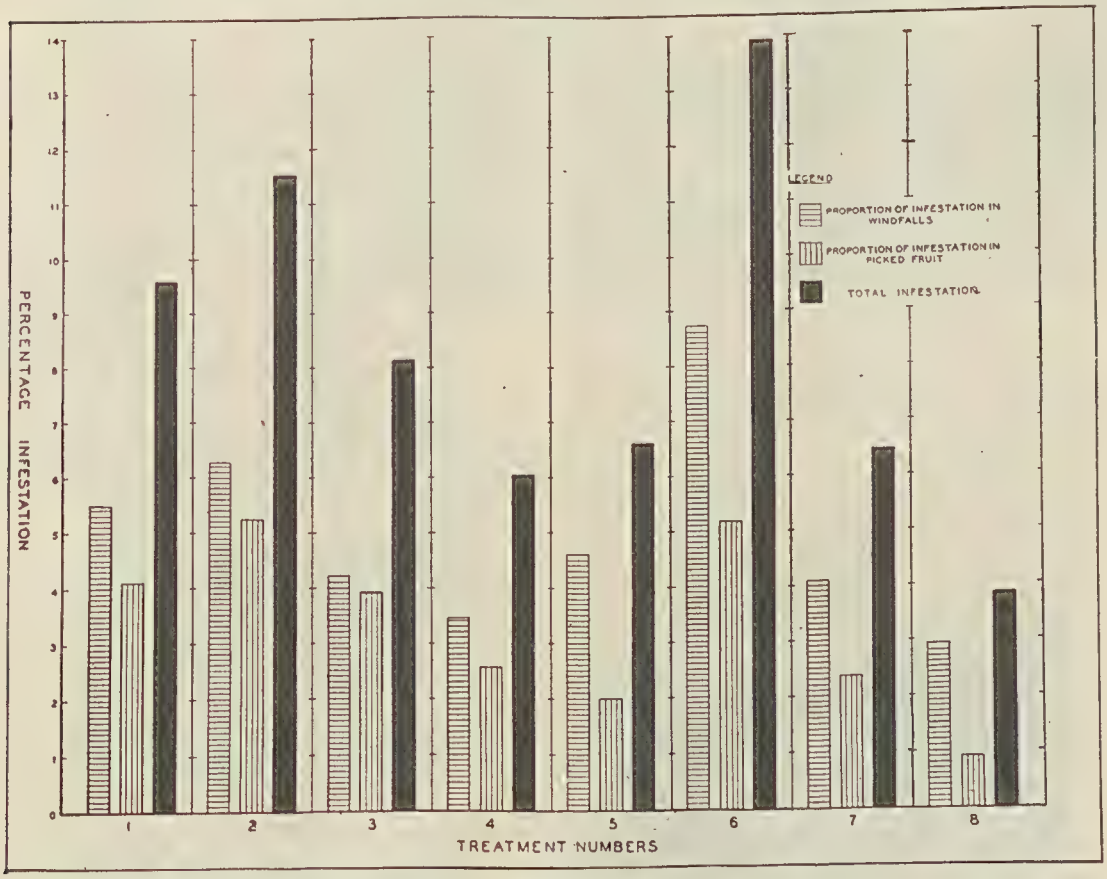
gallons was compared with a similar number of sprays of arsenate of lead paste 8 lb. to 80 gallons of water. (Programmes Nos. 3 and 4.)

(*c*) There was no significant difference in the infestation of the picked fruit where a spray programme consisting of two calyx and two cover sprays of arsenate of lead paste 5 lb. to 80 gallons of water was compared with one consisting of a single delayed calyx and two cover sprays of arsenate of lead paste 5 lb. to 80 gallons of water. (Programmes Nos. 3 and 6.)

(*d*) A spray programme consisting of two calyx sprays of arsenate of lead paste 5 lb. to 80 gallons of water, and two cover sprays of summer white spraying oil 1 gallon to 60 gallons of water, gave a significantly lower percentage of infestation in the picked fruit as compared with that resulting from a programme consisting of two calyx and two cover sprays of arsenate of lead paste 5 lb. to 80 gallons of water. (Programmes Nos. 3 and 5.)

(*e*) There was a significantly lower percentage of infestation in the picked fruit where a programme consisting of two calyx and two cover sprays of arsenate of lead paste 5 lb. plus summer white oil 1 pint, to 80 gallons of water, was compared with one consisting of two calyx and two cover sprays of arsenate of lead paste 5 lb. to 80 gallons of water. (Programmes Nos. 3 and 7.)

(*f*) There was a significantly lower percentage of codling moth infestation in the picked fruit where a programme consisting of two calyx and two cover



Graph IV.—Showing average percentage of codling moth infested fruit for each of the eight spray programmes. Ardmona, 1937–38.

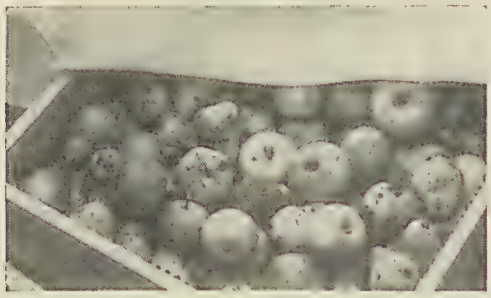
sprays of arsenate of lead paste 5 lb. plus summer white oil 1 gallon, to 80 gallons of water, was compared with one consisting of two calyx and two cover sprays of arsenate of lead paste 5 lb. to 80 gallons of water. (Programmes Nos. 3 and 8.)

(*g*) There was a significantly lower percentage of infestation in the picked fruit when a programme consisting of two calyx and two cover sprays of arsenate of lead paste 5 lb. plus summer white oil 1 gallon, to 80 gallons of water, was compared with one consisting of two calyx and two cover sprays of arsenate of lead paste 8 lb. to 80 gallons of water. (Programmes Nos. 8 and 4.)

The infestation by codling moth of the windfall fruit expressed as a percentage of the total fruit grown on each unit of treatment is set out in Table XIII.

TABLE XIII.—SUMMARY OF CODLING MOTH INFESTATION OF WINDFALL FRUIT EXPRESSED AS PERCENTAGE OF TOTAL FRUIT FOR EACH UNIT OF TREATMENT 1937-38.

6·85	8·40	4·18	6·45	4·51	6·54	4·72	3·48
6·68	5·96	3·24	5·94	8·99	4·33	2·78	4·93
2·65	3·13	7·01	11·98	3·63	2·52	4·35	6·75
2·12	4·48	9·66	5·41	2·67	4·56	5·17	6·01
3·95	4·66	2·22	2·77	4·95	5·90	3·57	3·99
4·94	1·62	2·34	4·63	3·35	3·44	2·30	3·09
3·83	3·22	6·86	5·21	4·09	2·59	4·25	11·96
3·70	6·67	8·56	3·78	3·90	3·59	10·95	6·86



A fruit tray showing typically infested fruit.

On examining statistically figures in Table XIII. the information shown in Table XIV. is obtained.

TABLE XIV.—STATISTICAL ANALYSIS OF INFESTATION OF WINDFALLS.

Analysis of Variance.

Due to—	Degrees of Freedom.	Sum of Squares.	Mean Square.
Rows	7	46·7720	
Columns ..	7	24·6174	
Treatment ..	7	190·4221	27·2032
Error	42	65·3248	1·5192
Total ..	63	327·1363	

$$\text{Standard error} = \sqrt{\frac{1{\cdot}5192}{8}} = {\cdot}4358$$

Significant difference = 1·22 per cent.
F value of experiment (actual) = 17·91
F 1% value of experiment = 3·1

On averaging the figures quoted in Table XIII., the following percentage of codling moth infested fruit in the windfalls is obtained for each of the spray programmes.

Programme No. 1	..	5.48 per cent.
Programme No. 2	..	6.25 per cent.
Programme No. 3	..	4.21 per cent.
Programme No. 4	..	3.47 per cent.
Programme No. 5	..	4.60 per cent.
Programme No. 6	..	8.71 per cent.
Programme No. 7	..	4.08 per cent.
Programme No. 8	..	2.94 per cent.

A study of the above figures together with the figure of 1.22 for significant difference as shown in Table XIV reveals the following facts:—

(*a*) The infestation in the windfall fruit resulting from a spray programme consisting of one calyx and two cover sprays of arsenate of lead paste 5 lb. to 80 gallons of water applied without reference to moth activity was significantly greater than that resulting from a programme of two calyx and two cover sprays of arsenate of lead paste 5 lb. to 80 gallons of water. (Programmes Nos. 1 and 3.)

(*b*) There was a significantly higher infestation of the windfall fruit where a spray programme consisting of two

calyx and two cover sprays of arsenate of lead paste 3 lb. to 80 gallons of water was compared with one consisting of two calyx and two cover sprays of arsenate of lead paste 5 lb. to 80 gallons of water. (Programmes Nos. 2 and 3.)

(*e*) There was no significant difference in the infestation of the windfalls where a spray programme consisting of two calyx and two cover sprays of arsenate of lead paste 8 lb. to 80 gallons of water was compared with one consisting of two calyx and two cover sprays of arsenate of lead paste 5 lb. to 80 gallons of water. (Programmes Nos. 3 and 4.)

(*d*) There was no significant difference in the infestation of the windfalls where a spray programme consisting of two calyx sprays of arsenate of lead paste 5 lb. to 80 gallons of water and two cover sprays of white oil 1 gallon to 60 gallons of water was compared with one consisting of two calyx and two cover sprays of arsenate of lead paste 5 lb. to 80 gallons of water. (Programmes Nos. 3 and 5.)

(*e*) There was a significantly higher infestation of the windfalls where a spray programme consisting of a single delayed calyx spray and two cover sprays of arsenate of lead paste 5 lb. to 80 gallons of water was compared with a programme consisting of two calyx and two cover sprays of the same strength arsenate of lead paste. (Programmes Nos. 3 and 6.)

(*f*) There was no significant difference in the infestation of the windfalls where a spray programme consisting of two calyx and two cover sprays of arsenate of lead paste 5 lb. plus summer white oil 1 pint, to 80 gallons of water, was compared with one consisting of two calyx and two cover sprays of arsenate of lead paste 5 lb. to 80 gallons of water. (Programmes Nos. 3 and 7.)

(*g*) There was a significant reduction in the infestation of the windfalls where a programme consisting of two calyx and two cover sprays of arsenate of lead paste 5 lb. plus summer white oil 1 gallon, to 80 gallons of water, was compared with one consisting of two calyx and two cover sprays of arsenate of lead paste 5 lb. to 80 gallons of water. (Programmes Nos. 3 and 8.)

Showing arrangement of the emergence cages—facing north, south, east, and west.

(*h*) There was no significant difference in the infestation of the windfalls when a spray programme consisting of two calyx and two cover sprays of arsenate of lead paste 5 lb. plus summer white oil 1 gallon, to 80 gallons of water, was compared with one consisting of the same number of sprays of arsenate of lead paste 8 lb. to 80 gallons of water. (Programmes Nos. 8 and 4.)

The average percentage of codling moth infested fruit for each of the eight spray programmes tested is shown in Graph IV. In each case the proportion of the total infestation in the picked fruit and in the windfall fruit is shown.

Bandaging Experiments:—The efficacy of different types of bandages as supplementary aids to spraying were tested out on a block of 80 Williams pear trees immediately adjacent to the spraying block. Four different types of bandages were used as follows:—

(*a*) Corrugated cardboard bandage chemically treated—impregnated with Beta naphthol;

(*b*) Double bandage—one hessian bandage and one chemically treated bandage on the same tree;

(*c*) Hessian bandages; and

(*d*) Corrugated cardboard bandage chemically treated—impregnated with Beta naphthol—at the completion of the first brood, this bandage was removed, and replaced with a fresh chemically treated bandage.

A chemical band on one of the experimental trees.

These plots were laid out in the form of a randomized block, each treatment being replicated five times, the unit of treatment being four trees. The bag bandages (*b*) and (*c*), were removed each week and the codling moth larvae recorded. The bandages of treatment (*a*) remained on the trees until the end of the season, but the chemically treated bandages of treatment (*d*) were removed at the conclusion of the first brood, and replaced by fresh bandages chemically treated.

Table XV. sets out in detail the counts of larvae obtained for each of the four treatments.

TABLE XV.—NUMBER OF LARVAE TRAPPED PER PLOT IN THE BANDAGING EXPERIMENTS.

Chemically treated bandage.	Double bandage.	Hessian bandage.	Chemically treated bandage (replaced after first brood).
14	43	48	9
17	49	32	25
16	51	35	17
31	74	32	39
21	99	58	16

On examining statistically the figures in Table XV. the results shown in Table XVI. are obtained.

TABLE XVI.—STATISTICAL EXAMINATION OF BANDAGING EXPERIMENT.

Analysis of Variance.

Due to—	Degrees of Freedom.	Sum of Squares.	Mean Square.
Blocks ..	4	1370·7	
Treatment ..	3	6229·8	2076·6
Error	12	2029·7	169·1
Total ..	19	9630·2	

$$\text{Standard error} = \sqrt{\frac{169{\cdot}1}{5}} = 5{\cdot}72$$

Significant difference = 16·02
F value of experiment (actual) = 12·28
F 1% value of experiment = 3·49

On averaging the figures in Table XV. it is found that the number of codling moth larvae obtained for each of the four treatments is as follows:—Chemically treated bandage, 19.8 larvae; double bandage, 63.2 larvae; hessian bandage, 41.0 larvae; and chemically treated bandage (replaced after first broad), 21.2 larvae.

It will be seen from a study of these figures together with the significant difference figure of 16.02 obtained in Table XVI. that there is—

(*a*) A significantly poor catch of larvae in the chemically treated corrugated bandages when compared with the catch of larvae in the hessian bandages. Treatments (*a*) and (*c*).

(*b*) There was a significantly improved catch of larvae in the double bandage treatment when compared with any other type of bandage. Treatments (*a*), (*b*), (*c*), and (*d*).

It should be noted, however, that 97.5 per cent. of the larvae captured in the chemically treated bandages were destroyed by the toxic action of the chemical. In the case of the hessian bandages, however, more labour is involved in examining them each week and destroying the larvae present.

In treatment (*b*) above, where there was a bandage of hessian and also a chemically treated bandage on each tree, it is of interest to note the numbers of larvae trapped in the hessian bandages when compared with the number of larvae trapped in the chemically treated bandages. Within each unit of four trees there were two trees with the bag bandage placed above the chemically treated bandage, while the positions were reversed on the remaining two trees. The same relative positions were observed in each unit of four trees throughout the block.

In Table XVII. is set out the catch of larvae in each of the components of this "double" bandage.

TABLE XVII.—THE NUMBER OF LARVAE TRAPPED IN THE COMPONENTS OF THE DOUBLE BANDAGE.

Replicate.	Hessian.	Chemically Treated.
1	33	10
2	39	10
3	36	15
4	57	17
5	81	18
Average ..	49·2	14·0

On examining statistically the figures in Table XVII., the information contained in Table XVIII. is obtained.

TABLE XVIII.—STATISTICAL EXAMINATION OF THE "DOUBLE" BANDAGE—ONE BAG AND ONE CHEMCALLY TREATED BANDAGE ON EACH TREE.

Analysis of Variance.

Due to—	Degrees of Freedom.	Sum of Squares.	Mean Square.
Blocks ..	4	1078·4	
Treatment ..	1	3097·6	3097·6
Error	4	592·4	148·1
Total ..	9	4768·4	

$$\text{Standard error} = \sqrt{\frac{148 \cdot 1}{5}} = 5 \cdot 4$$

Significant difference = 15·2
F value of experiment = 20·91
F 1% value of experiment = 7·71

Feeding jars which were used in the laboratory studies.

It will be seen from a study of the averages of the numbers of larvae caught in each type of bandage together with the figure of 15.2 for significance that there was a significantly poor catch of larvae in the chemically treated bandages when compared with the catch of larvae in the hessian bandages. This conclusion bears out the results obtained in the main bandaging experiment.

In treatment (*d*) of the bandaging experiment the chemically treated bandages were removed on the 14th of January, 1938, the number of larvae recorded, and fresh chemically treated bandages were placed on the trees. This was done in order to compare the numbers of first-brood larvae trapped in the bandages with the numbers trapped from later

broods. In Table XIX. are set out the catches of larvae from the first and later broods in chemically treated bands.

TABLE XIX.—NUMBERS OF LARVAE TRAPPED IN THE FIRST OR LATER BROODS WITH CHEMICALLY TREATED BANDAGES.

First Brood.	Later Broods.
8	1
17	8
11	6
26	13
14	2
Average .. 15·2	6

The results of statistical examination of the figures in Table XIX. are set out in Table XX.

TABLE XX.—STATISTICAL ANALYSIS OF THE CATCHES OF LARVAE FOR EACH BROOD.

Analysis of Variance.

Due to—	Degrees of Freedom.	Sum of Squares.	Mean Square.
Blocks ..	4	262·4	
Treatment ..	1	211·6	211·6
Error	4	22·4	5·6
Total ..	9	496·4	

$$\text{Standard error} = \sqrt{\frac{5{\cdot}6}{5}} = 1{\cdot}1$$

Significant difference = 3·0 per cent.
F value of the experiment = 37·78 per cent.
F 1% value of the experiment = 7·71

It will be seen from a study of the averages of the number of larvae trapped from the first and later broods, Table XIX., that the catch of first-brood larvae in the chemically treated bandages was significantly greater than the number of larvae trapped from the later broods.

Arsenical Residues.

In order to determine the arsenical residues on the fruit at picking time resulting from the various spray schedules, samples of twenty pears were taken from each of the units of the spraying block at both the first and second pickings, and submitted to the Agricultural Research Chemist for arsenic determination. The detailed results of analysis at the time of the first pick are shown in Table XXI.

TABLE XXI.—DETAILS OF ARSENIC RESIDUE FIGURES AT THE TIME OF THE FIRST PICK FROM EACH UNIT OF TREATMENT OF SPRAYING BLOCK.

(Grains of As_2O_3 per lb. of Fruit.)

·027	·023	·032	·035	·005	·028	·036	·042
·016	·023	·041	·007	·022	·025	·052	·023
·022	·030	·006	·026	·031	·028	·026	·021
·038	·004	·029	·038	·026	·021	·025	·029
·007	·028	·052	·031	·027	·018	·026	·036
·025	·026	·031	·031	·028	·017	·042	·006
·023	·038	·022	·027	·028	·040	·007	·027
·040	·027	·023	·027	·059	·007	·036	·044

In Table XXII. is set out the statistical analysis of the figures shown in Table XXI.

TABLE XXII.—STATISTICAL ANALYSIS OF THE ARSENIC RESIDUE ON THE FRUIT ARDMONA 1937-38.

Analysis of Variance.

Due to—	Degrees of Freedom.	Sum of Squares.	Mean Square.
Rows	7	·000417	
Columns ..	7	·000428	
Treatment ..	7	·006134	·000876
Error	42	·001388	·00033
Total ..	63	·008362	

$$\text{Standard error} = \sqrt{\frac{·000331}{8}} = ·00203$$

Significant difference = ·006
F value of experiment (actual) = 26·5 per cent.
F 1% value of experiment = 3·1 approx.

On averaging the figures for arsenic residues shown in Table XXI., the following figures (in grains of As_2O_3 per lb. of fruit) are obtained for each of the spray treatments.

Programme No. 1 .. 0.026 grains.
Programme No. 2 .. 0.023 grains.
Programme No. 3 .. 0.026 grains.
Programme No. 4 .. 0.040 grains.
Programme No. 5 .. 0.006 grains.
Programme No. 6 .. 0.028 grains.
Programme No. 7 .. 0.034 grains.
Programme No. 8 .. 0.036 grains

An examination of these figures reveals that at the time of the first pick, one spray programme only had a residue below the limit of 0.01 grains As_2O_3 per lb. of fruit prescribed by law, i.e., Programme No. 5, consisting of two calyx sprays of arsenate of lead paste 5 lb. to 80 gallons of water and two cover sprays of summer white oil 1 gallon to 60 gallons of water.

A study of the above figures, together with the figure obtained for significant differences in Table XXII., reveals the following:—

(*a*) Three of the spray programmes show arsenic residues that are significantly greater than that resulting from a programme consisting of two calyx and two cover sprays of arsenate of lead paste 5 lb. to 80 gallons of water. (Programme No. 3.) These programmes were—*Programme No.* 4, consisting of two calyx and two cover sprays of arsenate of lead paste 8 lb. to 80 gallons of water. *Programme No.* 7 consisting of two calyx and two cover sprays of arsenate of lead paste 5 lb., plus 1 pint of summer white spraying oil, to 80 gallons of water; and *Programme No.* 8 consisting of two calyx and two cover sprays of arsenate of lead paste 5 lb., plus 1 gallon of summer white spraying oil to 80 gallons of water.

(*b*) There was a significant reduction in the arsenic residues present where a programme consisting of two calyx sprays of arsenate of lead paste 5 lb. to 80 gallons, and two cover sprays of summer white spraying oil, 1 gallon to 60 gallons of water, was compared with the arsenic residues resulting from any other spray programme tested.

(*c*) There was no significant difference between the arsenical residues resulting from a spray programme consisting of two calyx and two cover sprays of arsenate of lead paste 5 lb. to 80 gallons of water, and that from a programme consisting of two calyx sprays and two cover sprays of arsenate of lead paste 3 lb. to 80 gallons of water.

The arsenic residues on the fruit at the time of the second picking were of much the same order as those shown in Table XXI.

Parasites.

During the 1937-38 season two hymenopterous parasites of the codling moth (*Cydia pomonella* L.) were observed. Those were the Ichneumon *Gambrus Stokesii* Cam., a pupal parasite, and a chalcid, bred from larval material collected in the field, which has been determined as *Stomatoceras pomonellae* Cam. by A. A. Girault. This insect is a parasite of the oriental peach moth in the Sydney district.

Summary.

The codling moth (*Cydia pomonella* L.) was in evidence in the Goulburn Valley during the season 1937-38, attacking pears. On the experimental block at Ardmona the infestation ranged from 3.83 per cent. to a maximum of 13.9 per cent., according to the programme under consideration.

The spring of the 1937-38 season commenced earlier than that of the previous season. The Williams pear trees at Ardmona were in blosssom approximately a fortnight earlier in the 1937-38 season than in the previous year. Similarly the emergence of the spring brood of the codling moth commenced approximately ten to fourteen days earlier.

In the laboratory at Mooroopna, life history studies revealed that, during the season, there were three broods of moths producing viable eggs—namely, the spring, first, and second-brood moths. A very small number of third-brood moths emerged in the laboratory late in the season, but did not oviposit. Of the larvae of the first brood 5.56 per cent. overwintered, of the second brood 22.22 per cent., and of the third brood 88.31 per cent.

In the field there were three broods of moths during the season 1937-38. Moths of the spring brood were trapped in the lures from 27th September, 1937, until 29th November, 1937, with a peak period on 1st November, 1937. The first moths of the first brood were trapped on 6th December, 1937. This brood showed several peaks of activity, the main one being on 11th January, 1938. Second-brood moths began to be trapped at the end of January—the actual date of appearance of this brood in the lures not being available, owing to overlapping of the two broods. There was a small peak for this brood on 17th February, 1938. Tests with different attractant solutions in lures revealed that both molasses and golden syrup were more attractive to codling moth than vinegar.

[Continued on page 572

Malting Barley Investigations

By Alan R. Raw, M.Agr.Sc., Cereal Geneticist

In the November, 1937 issue of this Journal the effect of the season upon yield of the barley plant, nitrogen content of the grain and 1,000 grain weight was dealt with for the years 1930 to 1936. In the following article it is proposed to discuss the effect of manuring upon yield.

MANURING.

Effect upon Yield.

AMONG those environmental characters which operate to modify the yielding ability of the barley plant, manuring occupies an extremely important position, being second only to climatic and seasonal conditions in the magnitude of its effect. From the practical point of view, manuring must naturally assume an added significance, since it alone, of all the major environmental factors is completely under control. The problem of manuring, as it relates to the malting barley crop, is an exceedingly complex one, since it necessarily involves, not only yield, but also quality, and any improvement in the former must be accomplished without detriment to the latter.

The problem has received a great deal of attention in oversea countries, and, as a result, an abundance of evidence is available to indicate the effect of the various artificial fertilizers upon yield, and upon malting quality (3, 6, 7, 11, 12, 13, 14, 15, 16). In Australia, however, this aspect of barley production appears to have been neglected until recent times, a neglect which is no doubt largely attributable to the fact that the crop is of minor importance in comparison with wheat in this country. Further, wheat is typically a fallow crop, and the remarkable response of such crops to phosphatic fertilizers has naturally tended to result in the general use of superphosphate for cereal crops, whether fallow or stubble sown.

It is only in recent years, following upon the work of Richardson *et al* (18, 19), in South Australia, that the problem has received any great attention, but the results of these preliminary investigations have already had the effect of entirely altering the manurial concept in relation to stubble crops. The early work of Howell (17) in this direction appears to have been overlooked or forgotten, but it is interesting to note that, as a result of extensive manurial trials conducted throughout Victoria in 1902-1903, he advocated the use of nitrogenous fertilizers for stubble crops in the southern areas of the State. In addition, he indicated light dressings of superphosphate in combination with sulphate of ammonia as being the most effective fertilizer to apply.

During the six seasons 1932 to 1937, manurial investigations with malting barley were conducted at the State Research Farm, Werribee. These embraced both fallow and stubble sown sections. The results which were obtained in each of these are considered in detail below.

Fallow Sown Barley.

The manurial trials on fallow embraced a series of seven different treatments as follow:—

1. No manure.
2. Superphosphate, 1 cwt. per acre.
3. Superphosphate, 1½ cwt per acre.
4. Superphosphate, 2 cwt. per acre.
5. Superphosphate, 1 cwt. + sulphate of ammonia, 1 cwt. per acre.
6. Superphosphate, 1 cwt. + sulphate of potash, 1 cwt. per acre.
7. Superphosphate, 1 cwt. + sulphate of ammonia, 1 cwt. + sulphate of potash, 1 cwt. per acre.

The results obtained from these plots, Table VI., during the six years under consideration, fall into three groups, each of which is characterized by a different set of factors limiting production.

Group I. (*Seasons* 1932 *and* 1935).—The outstanding feature of the manurial trials on fallow land in each of these seasons was the marked response on the part of the plant to

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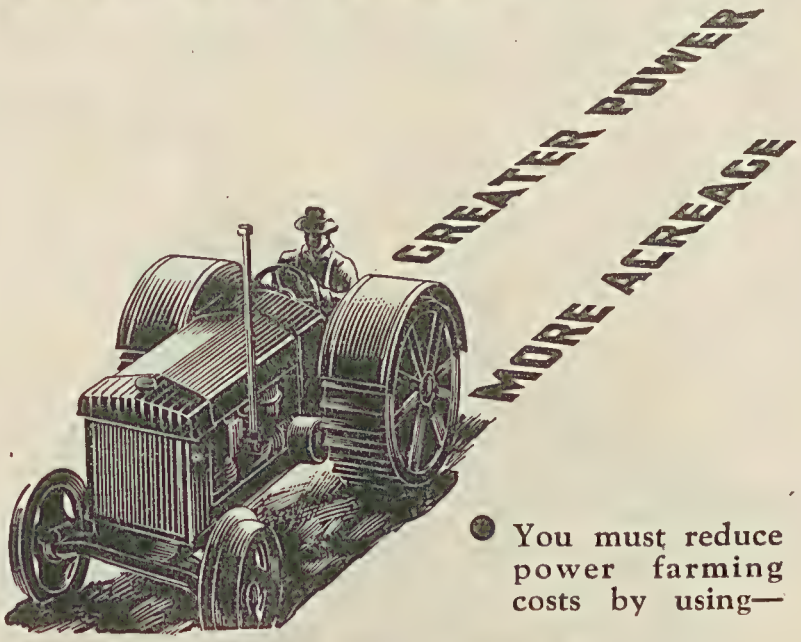

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TABLE VI.—BARLEY MANURIAL TRIALS.—PRYOR BARLEY, FALLOW SOWN.

Treatment.	Increase Due to Manure. Bushels per acre.					
	1932.	1933.	1934.	1935.	1936.	1937.
No Manure : Basal yield figure ..	24·6	32·6	41·3	36·6	33·3	30·6
Superphosphate, 1 cwt. per acre	2·6	3·8	19·6	3·6	4·6	9·7
Superphosphate, 1½ cwt. per acre	2·3	4·6	20·6	4·2	5·5	15·7
Superphosphate, 2 cwt. per acre	2·6	7·0	25·8	5·8	6·9	17·3
Superphosphate, 1 cwt. + Sulphate of Ammonia, 1 cwt. per acre	12·8	7·8	18·9	12·6	8·3	6·6
Superphosphate 1 cwt., + Sulphate of Potash, 1 cwt. per acre ..	3·5	3·8	19·6	1·6	4·5	8·8
Superphosphate, 1 cwt. + Sulphate of Ammonia, 1 cwt. + Sulphate of Potash, 1 cwt. per acre ..	10·5	9·6	18·9	13·8	8·7	6·0
Bushels required for significance ..	1·6	2·3	2·5	2·8	1·2	4·0

applications of sulphate of ammonia. Contrary to established ideas, the effect of superphosphate was practically negligible. In 1932, applications of 2 cwt. per acre of the 1 : 1 superphosphate-sulphate of ammonia mixture resulted in an increased yield of more than 50 per cent. over the "no manure" level, and of 38 per cent. over that of plots receiving dressings of 2 cwt. per acre of superphosphate alone. The superphosphate-sulphate of potash mixture exerted an effect upon yield similar to that due to superphosphate alone.

The behaviour of the plant under the various manurial treatments is indicated by the results of crop census investigations conducted on all plots during the seasons 1932 to 1934, Table VII. From a study of these results, it is apparent that the increase in yield per acre on the plots receiving dressings of the superphosphate-sulphate of ammonia mixture were due to an increase in the number of ears produced per foot of drill row, and to an increase in the size of ear, i.e., to a response of the plant in the direction of ear formation. On the other hand, superphosphate alone, or in combination with sulphate of potash, produced only a slight increase in numbers of ears per foot and in ear size. Sulphate of potash had no effect upon either of these characters.

In 1935, applications of 2 cwt. per acre of the superphosphate-sulphate of ammonia mixture produced a maximum increase in yield of 38 per cent. over the "no manure" level, and of 16 per cent. over that of the superphosphate, 2-cwt. per acre plots. The superphosphate-sulphate of potash combination again had no effect beyond that of the phosphate alone. Census data are not available for the plots grown during this or the two succeeding seasons.

TABLE VII.—CENSUS DATA—FALLOW MANURIAL TRIAL—PRYOR BARLEY.

Treatment.	1932.				1933.				1934.			
	Heads per Foot.	Grains per Head.	Weight per 1,000 Grains.	Yield per Acre.	Heads per Foot.	Grains per Head.	Weight per 1,000 Grains.	Yield per Acre.	Heads per Foot.	Grains per Head.	Weight per 1,000 Grains.	Yield per Acre.
			gms.	bus.			gms.	bus.			gms.	bus.
No Manure	9·3	15·9	50·9	24·6	13·0	17·1	42·5	32·6	14·7	17·0	50·1	41·3
Superphosphate, 1 cwt. per acre	9·9	16·5	50·5	27·2	14·8	17·7	42·0	36·4	22·4	17·0	48·4	60·9
Superphosphate, 1½ cwt. per acre	9·9	16·3	50·3	26·9	14·9	18·2	41·7	37·2	22·7	17·1	48·3	61·9
Superphosphate, 2 cwt. per acre	9·9	16·4	50·7	27·2	16·5	17·3	41·9	39·6	22·8	18·2	48·9	67·1
Superphosphate, 1 + Sulphate of Ammonia, 1 cwt. per acre	11·8	19·0	50·3	37·4	16·7	17·8	41·2	40·4	22·6	16·8	48·1	60·2
Superphosphate, 1 + Sulphate of Potash, 1 cwt. per acre	9·8	16·7	52·0	28·1	14·8	17·6	42·2	36·4	21·9	17·7	47·6	60·9
Superphosphate, 1 + Sulphate of Ammonia, 1 + Sulphate of Potash, 1 cwt. per acre	11·4	18·1	51·4	35·1	18·6	16·9	40·7	42·2	21·6	17·8	47·3	60·2

Manurial dressings on barley test plots. Left.—Superphosphate 1 cwt. per acre; Centre.—Super. 1 cwt. + sulpate of ammonia 1 cwt. per acre; Right.—No manure. Note the stages of development of the plants.—Maturity hastened by super.; delayed by sulphate of ammonia.

The response of the plant to nitrogen in these seasons was directly attributable to the weather conditions which prevailed during the earlier portion of the year. Excessive autumn rains had the effect of waterlogging the soil during these months, thus preventing cultivation, inhibiting nitrification and later resulting in excessive weed growth on the fallows. The combination of these conditions finally manifested itself in the form of a nitrate deficiency in the soils at seeding time, and the fallows assumed the characteristics of a normal stubble soil.

Group II. (*Seasons* 1933 *and* 1936).—In these seasons the response of the plant to the superphosphate-sulphate of ammonia combination was again apparent, but not to such a marked degree as in 1932 and 1935. On the other hand, the effect of superphosphate alone was more marked. The superphosphate-sulphate of potash mixture again had no effect beyond that of the phosphate alone.

In 1933, applications of 2 cwt. per acre of the superphosphate-sulphate of ammonia mixture resulted in an increase of 24 per cent. over the "no manure" level, 11 per cent. over that of plots receiving 1 cwt. per acre of superphosphate, and 2 per cent. in excess of that of the 2 cwt. per acre superphosphate plots. Corresponding increases for the season 1936 were as follows:—25 per cent, 10 per cent., and 3 per cent., indicating the remarkable degree of similarity between the two seasons. The yield increases in 1933 were again due to increased ear formation, and to slightly increased size of ear. The greatest increase in ear formation was exhibited by the superphosphate, 2 cwt., and the superphosphate-sulphate of ammonia 2 cwt. per acre plots.

The seasonal conditions operating during 1933 and 1936 undoubtedly exerted a modifying effect upon the action of the various fertilizers. Each season was characterized by dry autumn conditions, and soil conditions at seeding more nearly approached those of a typical fallow than in the seasons already discussed. As a result, soil nitrate levels were higher, though in each case the effect of the deficiency in the previous season was still apparent. Because of this the action of applied nitrogen on the crop was less severe, while the response to phosphatic manures was more marked. In 1932, and again in 1935, nitrogen was the major manurial factor limiting production. In 1933 and 1936, nitrogen and phosphates assumed this role.

Group III. (*Seasons* 1934 *and* 1937).—The outstanding feature of these two seasons was the marked response of the plant to dressings of superphosphate alone. In neither case did sulphate of ammonia or sulphate of potash exert any effect upon yield. In 1934, applications of 1 cwt. per acre of superphosphate resulted in an increase in yield of 45 per cent. over the basal "no manure" level. Additional dressings of this manure up to 2 cwt. per acre increased this figure to 62 per cent. Corresponding increases for 1937 were 32 per cent. and 57 per cent. Census data in 1934 indicated that the increases in yield were due to increased ear formation on the part of the

plant and, in the case of plants receiving dressings of superphosphate, at the rate of 2 cwt. per acre, to an increase in ear size.

The seasonal influence on manuring was again obvious in 1934 and 1937. In each case good rains were experienced during the early portion of the year, and conditions generally were conducive to the development of a typical fallow. That such was achieved is evidenced by the lack of response to nitrogen, indicating an ample supply of soil nitrates at seeding, and by the marked response to phosphatic manures. In each of these seasons the major manurial factor limiting production was definitely phosphate.

From a general consideration of the results it is obvious that the seasonal influence upon fallow-sown manurial trials with barley is of prime importance. In this respect it appears to be moderately safe to assume that the character of the early portion of the season will largely determine the degree of response to the different fertilizers. Thus an excessively wet autumn may be expected to indicate the necessity for nitrogeneous manures for the fallow crop, while, on the other hand, normal conditions prior to seeding would naturally suggest the application of phosphates.

The results obtained during 1932, 1933, 1935, and 1936 have introduced an entirely novel conception in regard to the problem of manuring fallow-sown cereal crops under local conditions. The preconceived idea of phosphorus as the major limiting factor in the production of such crops at Werribee must be revised in the light of these results. During the four seasons under consideration, nitrogen has definitely operated as a factor limiting production, during two of them as the major factor.

This fact assumes an added significance when it is realized that similar weather conditions to those prevailing during the early portions of 1932 and 1935, were experienced during 1931, 1928, and 1924, and it is more than probable that the fallows in these seasons were typically nitrate deficient. Thus, on no fewer than five occasions during the last fifteen years autumn weather conditions were such as to suggest that the application of nitrogenous manures to fallow-sown barley not only would be profitable, but also essential for economic crop production. It therefore appears that the question of manuring the fallow-sown barley crop must be revised to the extent of allowing for a season in which nitrate will replace phosphate as a major limiting factor, approximately once in three years. From the evidence in hand it appears that such seasons are predictable from autumn rainfall data.

While these results must necessarily be accepted as being representative of a strictly localized set of conditions, it is probable that they would find application over a much wider range, particularly in the higher rainfall areas of the State, such as the Central, Western, and Gippsland districts, which embrace between 30 and 40 per cent. of the malting barley areas. In the lighter rainfall areas it is probable that the nitrogen level in the fallows never falls as low as that of a southern

Showing the effect of superphosphate (left and right) in hastening maturity. The centre plot was unmanured.

A later stage, than that shown in the previous illustration, showing the plots approaching maturity. The effect of the superphosphate is still apparent.

stubble soil, and for this reason no response to the application of nitrogenous fertilizers would be expected in such areas.

The effect upon yield of the various fertilizers may be summarized as follows:—

Nitrogen.—This results in increases in yield in seasons when the nitrate content of the fallow is sub-normal. In such seasons nitrogen assumes the proportions of a major limiting factor.

Phosphorus.—Of all the manures tested, this exerts the greatest effect upon yield, and furnishes the major limiting factor to production in all seasons when the nitrate content of the soil is in the vicinity of normal.

Potash.—Potassic fertilizers exert no apparent effect upon the yield of fallow-sown barley crops at Werribee.

Stubble Sown Barley.

The manurial trials on stubble land embraced a series of seven different treatments as follows:—

1. No manure.
2. Superphosphate, ½ cwt. per acre.
3. Superphosphate, 1 cwt. per acre.
4. Superphosphate and sulphate of ammonia, 1 : 1 mixture, 1 cwt. per acre.
5. Superphosphate and sulphate of ammonia, 1 : 1 mixture, 2 cwt. per acre.
6. Superphosphate and sulphate of ammonia, 2 : 1 mixture, 1½ cwt. per acre.
7. Superphosphate and sulphate of ammonia, 1 : 2 mixture, 1½ cwt. per acre.

During 1933 two additional treatments, sulphate of ammonia ½ and 1 cwt. per acre, were included. Because of irregularities in germination and subsequent development, owing to unfavorable seasonal conditions, the 1932 stubble sown manurial trials were abandoned. The results obtained during the five seasons 1933 to 1937, Table VIII., were strikingly similar in character, and may be considered in conjunction with one another. The outstanding feature of these trials was the very marked response of the plant to applications of nitrogenous fertilizers, and the results indicated beyond doubt the role of nitrogen as the major manurial factor limiting production in stubble sown barley. Each season was marked by an almost complete absence of response to superphosphate applied alone. In comparison with the fallow manurial trials the lack of seasonal influence upon the manurial problem was most striking.

TABLE VIII.—BARLEY MANURIAL TRIALS.—PRYOR BARLEY, STUBBLE SOWN.

Treatment.	Increase Due to Manure. Bushels per acre.				
	1933.	1934.	1935.	1936.	1937.
No Manure : Basal yield figure	28·4	28·0	13·6	18·8	7·3
Superphosphate, ½ cwt. per acre	3·5	0·1	0·6	1·2	0·3
Superphosphate, 1 cwt. per acre	3·5	0·4	0·4	1·5	0·4
Superphosphate : Sulphate of Ammonia, 1 : 1, 1 cwt. per acre	9·2	4·7	5·0	5·0	5·7
Superphosphate : Sulphate of Ammonia, 1 : 1, 2 cwt. per acre	15·7	8·8	8·8	7·7	10·1
Superphosphate : Sulphate of Ammonia, 1 : 2, 1½ cwt. per acre	14·0	7·2	6·8	6·8	..
Superphosphate : Sulphate of Ammonia, 2 : 1, 1½ cwt. per acre	9·4	7·5	5·0	5·2	..
Sulphate of Ammonia, ½ cwt. per acre..	6·1	..	..	..	..
Sulphate of Ammonia, 1 cwt. per acre	8·2	..	..	..	..
Bushels required for significance	2·1	2·2	1·0	1·9	1·0

In each case the increases in yield due to applied nitrogen were progressive, and there was no indication to suggest that the upper limit of profitable manuring was approached by any of the dressings applied. In the majority of seasons the use of superphosphate alone proved to be definitely unprofitable. Crop census investigations conducted on the plots during 1933 and 1934 revealed (Table IX.) that increases in yield were due to a stimulation of ear formation on the part of the plant, coupled with an increase in ear size. This was particularly noticeable in the case of those plots receiving the heavier dressings of ammonium sulphate in combination with superphosphate.

The results obtained in these trials link up very closely with those of the South Australian investigators and with the conclusions drawn from more recent work in Victoria (20, 21, 22). In view of this it is extremely probable that they will find application throughout the bulk of the southern barley areas of Victoria. The fact that, by the judicious use of nitrogenous fertilizers, the yield level of a stubble sown crop may, in normal seasons, be made to profitably approach that of one sown on fallow, is bound to have a far-reaching effect, since it is a problem of economic import both to the producer and to the State. Because of this, the findings must exert a very definite influence upon the stubble cropping of the future.

A second feature which has been brought out during the investigations is the lack of response of these stubble sown barley crops to superphosphate when applied alone. In only one season of the five under consideration was a significantly profitable response observed with applications of this manure. Dressings up to ½ cwt. per acre may or may not be economically sound, but anything in excess of this quantity does not appear to be warranted under local conditions.

A further interesting feature is indicated by the response of the crop to applications of sulphate of ammonia alone and in the various combinations with superphosphate. The 1933 results suggested a greater response to nitrogen

TABLE IX.—CENSUS DATA—STUBBLE MANURIAL TRIAL—PRYOR BARLEY.

Treatment.	1933.				1934.			
	Heads per Foot.	Grains per Head.	Weight per 1,000 Grains.	Yield per Acre.	Heads per Foot.	Grains per Head.	Weight per 1,000 Grains.	Yield per Acre.
			grams	bushels			grams	bushels
No Manure	12·1	16·0	44·5	28·4	11·6	14·8	49·5	28·0
Superphosphate, ½ cwt. per acre ..	13·1	16·8	43·7	31·9	11·5	15·4	48·0	28·1
Superphosphate, 1 cwt. per acre ..	13·0	17·0	43·8	31·9	11·2	15·8	49·0	28·5
Superphosphate : Sulphate of Ammonia, 1 : 1, 1 cwt. per acre	15·3	17·2	43·4	37·6	12·8	16·1	48·1	32·7
Superphosphate : Sulphate of Ammonia, 1 : 1, 2 cwt. per acre	17·0	18·0	43·6	44·1	13·6	16·6	49·1	36·7
Superphosphate : Sulphate of Ammonia, 1 : 2, 1½ cwt. per acre	16·0	18·6	43·2	42·4	12·7	17·0	49·3	35·2
Superphosphate : Sulphate of Ammonia, 2 : 1, 1½ cwt. per acre	15·0	17·7	43·1	37·8	13·5	16·4	48·6	35·5

in combination with superphosphate than to nitrogen alone. Furthermore, they indicated certain of the superphosphate : sulphate of ammonia combinations as being superior to the remainder in this regard. Thus, the 1 : 1 combination appeared to be better suited to the full development of the plant than either the 2 : 1 or the 1 : 2 mixtures, and plots receiving dressings of 2 cwt. per acre of the 1 : 1 combination exhibited the greatest degree of response during 1933, and maintained it during the four succeeding seasons.

The explanation of this phenomenon would appear to lie in the fact that, with the removal of nitrogen as a limiting factor, phosphorus immediately assumes the major role. Where nitrogen is withheld from the plant, there is practically no response to applications of superphosphate. On the other hand, applications of nitrogen result in an immediate response, which is, however, limited by the amount of available soil phosphate. Thus, in 1933, applications of 1 cwt. per acre of superphosphate increased the yield over that of the "no manure" level by only 12 per cent.; 1 cwt. per acre of sulphate of ammonia alone raised this figure to 29 per cent., while 1 cwt. per acre of the 1 : 1 combination was responsible for an increase of more than 32 per cent., and 2 cwt. further increased this to 55 per cent.

These results were further substantiated by those obtained during the period 1934 to 1937. In all cases it has been found that the 1 : 1 combination yields the most striking results. In three of the four seasons 1933 to 1936, dressings of 1½ cwt. per acre of the 2 : 1 combination yielded similar results to those obtained with applications of 1 cwt. per acre of the 1 : 1 mixture. On the other hand, the results from plots receiving applications of 1½ cwt. per acre of the 1 : 2 mixture, while superior to the above, are not so striking as those obtained from dressings of 2 cwt. per acre of the 1 : 1 combination, even though the actual amount of nitrogen applied is the same in each case. In short, 1 cwt. of sulphate of ammonia is more effective in combination with 1 cwt. of superphosphate than with half that amount. Similarly, ½ cwt. of sulphate of ammonia is equally effective in combination with ½ cwt. or with 1 cwt. of superphosphate.

It appears that with the addition of nitrogen to the stubble soil, the addition of phosphate becomes essential, since the removal of the primary major limiting factor introduces a secondary one, phosphorus. For this reason, the superphosphate : sulphate of ammonia combinations are more efficient than either of the components alone. Furthermore, owing to the definite nitrogen : phosphorus balance required by the plant, the 1 : 1 superphosphate : sulphate combination appears to be the most efficient.

The effect upon yield of the various fertilizers upon the yield of stubble sown barley may be summarized as follows:—

Nitrogen.—This results in marked increases in yield in all seasons, since nitrogen fills the role of the major manurial factor limiting production in stubble soils. Increases in yield are progressive as the amount of nitrogen applied is increased.

Phosphorus.—The effect of phosphatic fertilizers alone is strictly limited. Applications in excess of ½ cwt. per acre are generally uneconomic. Where nitrogen ceases to operate as a limiting factor, phosphorus assumes this role. The greatest effect upon yield is obtained when the two are applied in combination. In this regard the 1 : 1 superphosphate : sulphate of ammonia mixture appears to be the most effective.

By A. W. Jessep, M.Agr.Sc., B.Sc., Dip. Ed., Principal, School of Horticulture, Burnley.

The Flower Garden.

THE warm weather of the past few weeks has suited many of the spring-flowering shrubs, and they have given bright splashes of colour to the gardens. Now is the time to cut back those shrubs that have finished flowering, such as Choisya ternata—the American white orange flower—, Deutzias, Cytisus, Genistas, and Weigelas. They then give out new growths on which develop the next crop of flowers.

Cut off all spent rose flowers and tie up the long branches of the climbing varieties. The spring-flowering annuals may still be in bloom, but provision must be made for summer flowers at the expense of removing the spring ones even before they begin to fade.

Sow seeds of Zinnia, Cosmos, Dianthus, Tithonia, Salvia, Marigold, and Celosia. Plant seedlings of Aster, Zinnia, Petunia, Bonfire salvia, Marigold, and Begonias. Make further plantings of Gladioli, and prepare the ground for planting Dahlias in early December.

Cultivation of the Dahlia.

As an autumn flower both for garden and interior decoration, the dahlia is difficult to beat. They are very easy to grow in most types of garden soils, but they attain perfection in deep, well-drained loamy ground. If the soil is light, add cow manure, but for heavy soils a good dressing of farmyard manure well dug in is better. Where dahlias are grown in the back garden and ground can be spared, sow a crop of peas and barley in May, and dig it under in September. When planting time comes, fork the ground over lightly.

Dahlias should be lifted after the first frost in June and stored in a sheltered spot until this month. If they have commenced to grow, the shoots should be cut off at the base, about ¼ inch from the tuber, which should then be divided into as many portions as possible.

The bud is only found close to the stem portion. No matter how large the tuber, there will be no growth from it unless the bud or bud portion is present.

Early December is the best time to plant; if earlier, hot weather may scorch the blooms; if later, the flowering period will be shortened by the cold nights in May. Plant about 2 feet apart —the bedding varieties a little closer, the giant types a little wider apart. Before planting, drive

in the stakes which should be of 1″ x 1″ Jarrah. If this is not done until after planting, there is a chance of injuring the tubers. When planting, place the bud end against the stake; later on this will facilitate the tying up operations. If green plants are used, place them about 1 inch deeper than they were in the pots; if the weather is very hot, protect them with twigs or something else to break the direct rays of the sun. Do not allow them to get dry; those that get a severe check seldom fully recover.

If the soil is in a good condition when the tubers are placed in it they will need no attention for the next four weeks, by which time they should be about 1 foot above ground. As soon as they are tall enough they should be tied to the stakes and from then on forced along. About mid-January, give them a dressing of market garden manure or blood and bone at the rate of 3 oz. per square yard. Dutch-hoe it in and give a good watering. At the beginning of February put on a heavy mulch of farmyard manure of the straw type. This is not so much for plant food, as to keep the soil at a more even temperature, to conserve the moisture, to allow watering to take place without puddling the surface soil, and to enable working to be carried on among the plants without consolidating the damp soil. If the soil is rather poor in plant food, or if the plants are not growing well, an additional application of market garden manure may be given.

Disbudding.

The usual reason for disbudding dahlias is to obtain a smaller number of larger blooms, or blooms with long stalks for indoor decoration. The common method is to remove the two outer buds and leave the centre one, and if very long stems are required to remove also the two laterals next down the stem. If dahlias are cut early in the morning, and the ends either burnt or left in boiling water for about 20 minutes, they will last for some days, providing the water in the bowl is changed daily.

Varieties.

There are hundreds of good varieties on the market, and they vary from the small Charm to the giant types. For house decoration, the small types are very useful; of these—Aglaia (orange-fawn), Dazzle (orange-scarlet), Baby Royal (flame pink), and Sunkist (salmon-rose), can be recommended. Jane Cowl (bronze), Grace Curling (pale lilac), Kathleen Norris (rose-pink), and Pink Daily Mail are standard giant varieties. In between these two extremes are

The Cactus Dahlia.

medium-sized varieties, such as Dorothy Allender (orange flame), Mrs. D. A. Swanson (salmon), Dr. Spath (lilac), Schiller (glowing salmon), Andraes Hofer (deep salmon with pale centre), and Ullswater of a beautiful pink shade.

If the flowers are picked as they open the bushes should go on blooming from early March until the cold nights of May.

VEGETABLES.

Further sowings of Greenfeast peas, bush and climbing beans, vegetable marrows, squashes, and cucumbers should now be made, while tomatoes, herbs, spinach, and summer cabbages may be planted out.

During the summer, the Dutch hoe should be used freely, and where obtainable, straw mulches should be put on the beds. The mulch not only prevents the loss of moisture, but keeps the soil at a more uniform temperature and prevents puddling during watering.

Cucumber.

The cucumber can be easily grown from now until the first frosts. They are fairly free from disease, and, if a medium water supply is available, they will do well in most soils, particularly the lighter types to which a fair dressing of farmyard manure has been added. It is advisable to grow them in a different area every

year, but if this is not possible, at least they should not be grown in the same spot year after year.

After preparing the ground, plant 4 to 6 seeds, each 3 to 4 inches apart and about 1 inch below the surface, in hills 4 feet apart each way. The word "hill" came into use because such seeds were formerly planted in groups on areas raised about 1 foot above the level of the surrounding bed. When the plants are established, work into the soil a good dressing of market garden manure and water it well. Top dress with straw or stable manure. If the plants send out runners from 2 to 3 feet long on which there is no sign of fruit, cut off the tips with a sharp spade; this will cause lateral branches to grow, and on these, fruits usually develop. Keep the ground well watered to ensure quick growth and crisp fruit.

Cucumbers are ready for picking when nearly full-grown and before the skin commences to turn yellow. A good one will be brittle enough to snap in half easily.

Varieties.

Apple Shaped or Round Early is a white-skinned almost round variety which is quick to mature. It is excellent in flavour and very digestible. White Early also matures early and is similar in colour and flavour to Apple Shaped or Round Early, but is elongated in shape. Long Green takes longer to mature, but at the present time is the most popular type, though it is not thought that the flavour is so good as that of the white-skinned varieties, which, when better known, should become very popular.

Orchard Notes

By J. L. Provan, B.Agr.Sc., Senior Horticultural Instructor.

Orchardists have experienced extremely dry weather conditions this spring, and the importance of soil tilth in relation to moisture holding capacity has been apparent. It has been observed that soils which are rich in humus, and which were cultivated in August to suppress weed growth, retained their moisture better than soils of very low humus content and which were cultivated later in the spring. An added danger of late cultivation is that, if it should coincide with warm, moist conditions, black spot development is favoured and may prove difficult to control even in orchards where thorough preventive spraying is practised. Fertilizer experiments conducted at Upper Beaconsfield have shown that where the soil fertility was improved by manurial applications and the ploughing under of cover crops, the moisture holding capacity increased by 14 per cent.

At this time of the year, growers anxiously watch the thinning of the crop after blossoming. Only a small percentage—sometimes 2 to 5 per cent. of the blossoms—set fruit, and even this setting is subsequently reduced by the dropping of young fruits. The production of fruit by a tree is essentially a means of reproduction and the parent tree stores in the seeds sufficient food reserves to nourish the young seedling after germination and before it commences to manufacture its own food requirements. The edible portions of modern fruits, however, are really modifications of the seed pods or flower parts, and they have been continuously improved until they are now comparatively large store-houses of manufactured plant food. It will be apparent, therefore, that two essentials will be necessary for the setting of fruit—first the tree must have the food supply to give vitality to the blossoms, and subsequently it must be able to make food supplies to be stored in the fruits and to maintain the growth of the tree.

Investigations of the food supply have shown that the ratio of nitrogen to carbohydrates (starches, sugars, &c.) in the tree largely determines the amount of fruit which sets. The nitrogen content of the tree can be increased by applications of sulphate of ammonia, or blood manure, to the soil. Each of these fertilizers, if applied in sufficient quantities, will stimulate the tree's growth, thereby producing more leaves which are the plant's food factory for the supply of starches, sugars, &c. Cross-pollination, in the majority of apple, pear, plum and cherry varieties, of course, plays an important role, and weather conditions at blossoming time also have their effect on the amount of fruit which sets. Various workers have observed the effect of dry weather conditions on the setting of Washington Navel oranges and almonds. In seasons when hot dry winds are experienced in Victoria, during November and early December, the shedding of young Washington Navel oranges has been heavier than in calmer and more humid seasons. Two remedies suggest themselves to overcome this, viz., breakwinds and adequate soil moisture.

The irrigation of apricots in some districts could be reduced in an attempt to increase the quality of the fruit, and decrease the susceptibility

to brown rot. Colour and firmness of the fruit would be improved and result in less marketing difficulties.

Towards the end of November a dry-mix lime sulphur spray—25 lb. per 100 gallons—should be applied to canning peach trees to control brown rot. For dessert peaches, this late November spray should be wettable sulphur—4 lb. per 100 gallons. Do not spray apricots with material containing sulphur.

Chemical or hessian bands, for the control of codling moth, should be placed around the trunks of apple, pear and quince trees before the end of this month. If the maximum effect is to be obtained from these bands, all other forms of cover for the codling moth larvae such as loose bark, broken limbs, debris, &c., should be removed and crevices blocked up. Codling moths have been active for more than a fortnight now, and some rather large "catches" were obtained in the lure pots on the demonstration plots during the third week of October. This may result in a higher percentage of calyx infections, if the calyx sprays have not been very thoroughly applied. Usually the spring peak period of codling moth flight occurs during the first week in November, and cover sprays, if applied up to ten days after this period, will have their maximum effectiveness. This season there are indications of an earlier peak, and therefore growers are advised to keep in touch with their local orchard supervisors and the lure charts posted in prominent places in their districts.

In orchards, where red spider becomes prevalent, nicotine sulphate at the rate of 1 pint in 80 gallons should be added to the first cover spray of lead arsenate (5 lb. paste in 80 gallons) for control of both red spider and codling moth. The nicotine sulphate can also be added to the white oil sprays. Spray the underside of the leaves thoroughly.

The application of white oil emulsion sprays to citrus trees during November and early December is likely to cause an increase in the "drop" of young fruits. In some cases this "drop" has been severe and caused heavy losses to growers.

A recent publication by the Council for Scientific and Industrial Research is pamphlet No. 80 entitled "The Storage of Oranges with Special Reference to Locality, Maturity, Respiration and Chemical Composition." This publication contains much valuable information on many phases of citrus handling.

Codling Moth and Williams Pears. *(continued from page 561.)*

In the spraying experiment in the field, eight different spray programmes were used, the minimum codling moth infestation of 3.83 per cent. being obtained with a spray programme consisting of two calyx and two cover sprays of arsenate of lead paste 5 lb., plus summer white oil 1 gallon to 80 gallons of water. This programme gave a control of codling moth that was significantly superior to one consisting of the same number of sprays of arsenate of lead 5 lb. to 80 gallons of water.

It was found that a reduction of the quantity of arsenate of lead paste from the customary 5 lb. to 3 lb., in 80 gallons of water, gave an inferior control when applied as a schedule of two calyx and two cover sprays. An increase in the amount of arsenate of lead paste to 8 lb. in 80 gallons of water in a similar schedule, did not increase the degree of control above that obtained with the usual strength of 5 lb. to 80 gallons of water.

The use of a single delayed calyx application gave an inferior control of codling moth as compared with that from the normal programme with two calyx applications.

Field tests conducted with different types of bandage revealed that the normal bag or hessian bandage trapped a larger number of larvae than chemically treated corrugated bangages. Of the larvae trapped in the chemically treated bandages 97.5 per cent. were dead.

It was found that the treated bandages trapped a larger number of larvae from the first brood than from the succeeding broods.

Of the eight programmes used in the field spraying experiments one only gave an arsenic residue on the fruit at either of the harvestings below the limit prescribed by law. This programme consisted of two calyx sprays of arsenate of lead paste 5 lb. to 80 gallons of water and two cover sprays of summer white oil, 1 gallon to 60 gallons of water.

Two parasites of the codling moth were observed during the course of the investigation.

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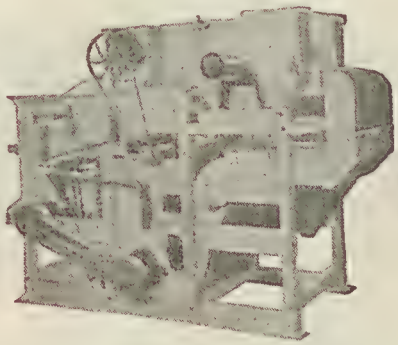

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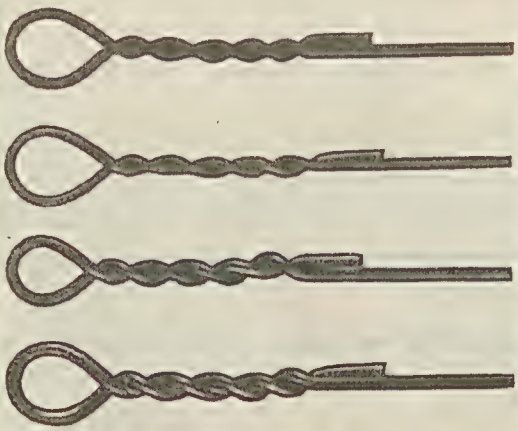

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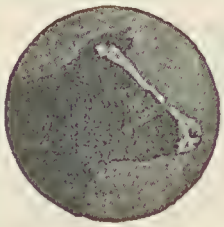

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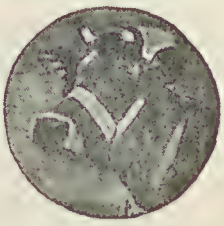

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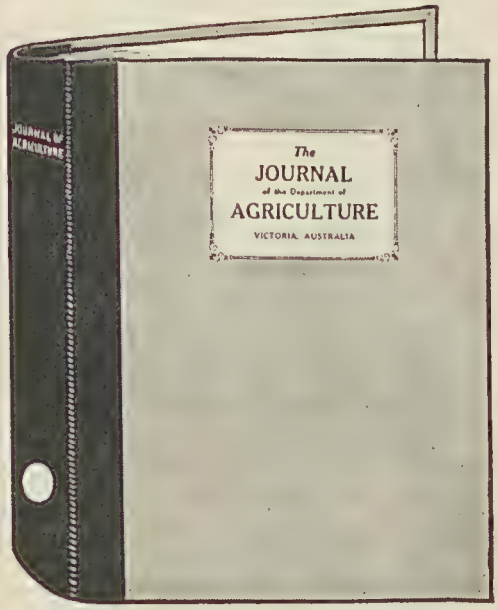

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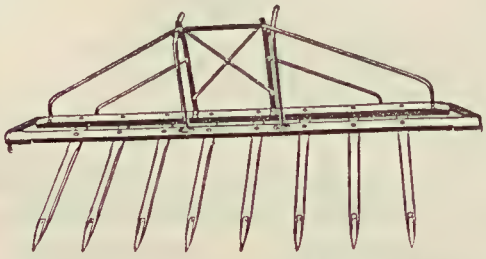

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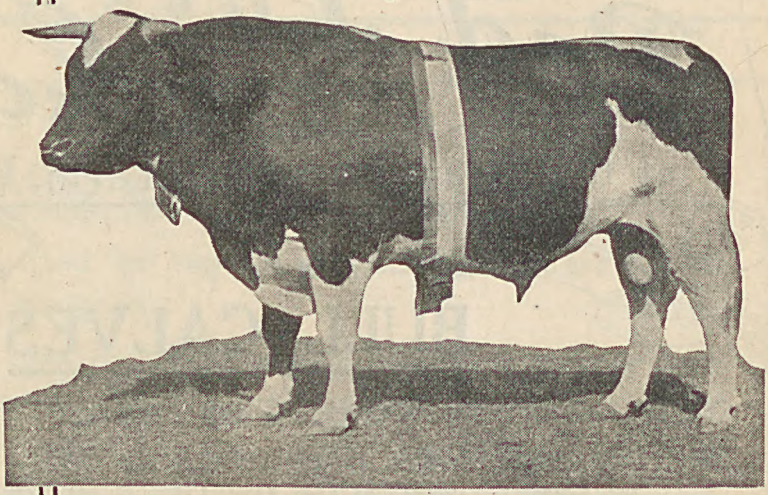

Victoria Joyous Mercedes

Dam:

Victoria Joybell, produced 15,387 lb. milk, 3·67 % test, 565 lb. butter-fat in 273 days, twice-a-day milking.

Daughters:

His eight (8) first-calf daughters have averaged 9,930 lb. milk, 3·73 % test, 370 lb. butter-fat in 273 days on first lactations.

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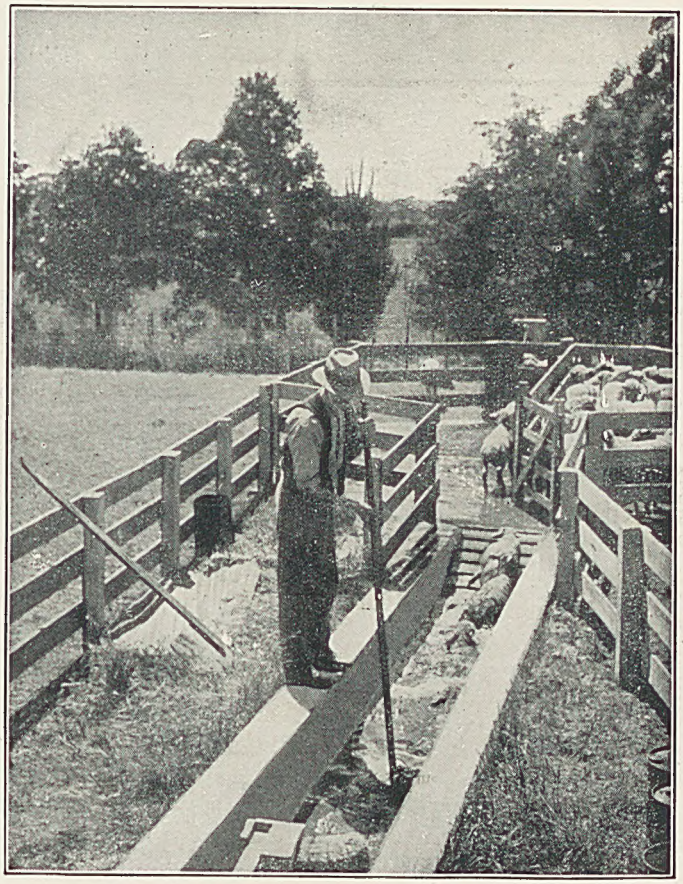

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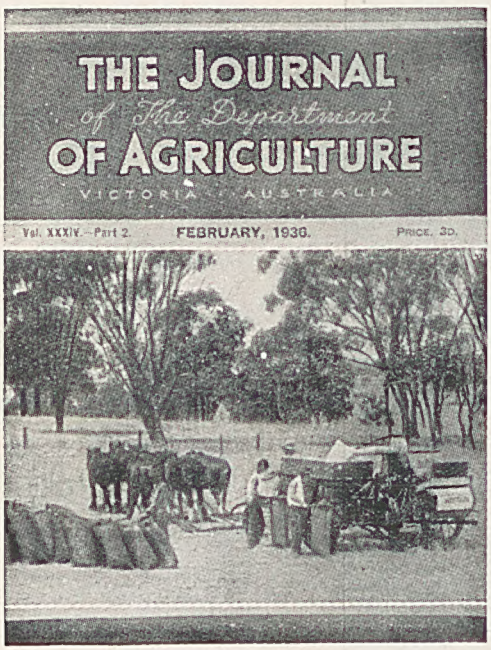

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